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March 26, 1990

Mr. W. Thomas Amen
Amen, Keith & Berg
847 Sansome Street
San Francisco, CA 94111

LETTER OF TRANSMITTAL

Dear Mr. Amen:

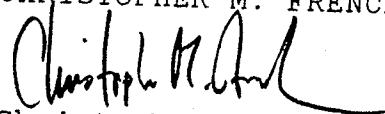
Transmitted herewith are four copies of the report titled "Phase I Report for Property Located in San Francisco, California".

Additional* documentation pertaining to the discovery, handling, transport and disposal of potentially hazardous waste, discovered at or near the subject property during construction activities associated with the Yosemite Fitch Outfall project, was submitted to Amen, Keith & Berg by the City and County of San Francisco in November, 1989. This documentation could unfortunately not be incorporated into the final report.

Should you have any questions, please call.

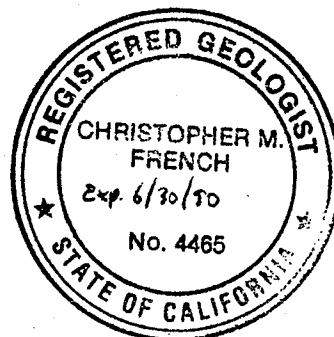
Very truly yours,

CHRISTOPHER M. FRENCH, R.G.



Christopher M. French, R.G.
Registered Geologist # 4465 (Exp. 6/30/90)
Registered Environmental Assessor #307 (Exp. 6/30/90)

Enclosure



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ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT
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March 20, 1990

Mr. W. Thomas Amen
Amen, Keith & Berg
847 Sansome Street
San Francisco, CA 94111

Subject: Phase I Report for Property located in San Francisco, CA

Dear Mr. Amen:

Christopher M. French, R.G. is pleased to present this Phase I report for property located in the vicinity of the Yosemite-Fitch Outfall Consolidation project in the City and County of San Francisco, California. The scope of work included a compilation and evaluation of findings to date pertaining to 1) physical setting, 2) contaminant source verification, 3) hazardous waste characterization, and 4) risk assessment.

1.0 BACKGROUND AND EXECUTIVE SUMMARY

Amen, Keith & Berg retained Christopher M. French, R.G. for the purpose of evaluating the presence or absence of hazardous waste potentially present beneath property located within the area of the Yosemite-Fitch Outfall Consolidation (YFOC) project in the South Basin area of southwest San Francisco, California. The location of the subject property is shown in Plate 1, Attachment A. A plot plan of the subject property is presented in Plate 2.

The City and County of San Francisco proposed construction of the YFOC transport/storage facilities in order to reduce sewage overflows and to transport wet and dry weather flows to treatment and/or pumping plants. The project encompassed a sixteen block area surrounding the Fitch Street, Griffith Street and Yosemite Avenue outfalls.

Geotechnical and environmental studies were completed prior to construction. A hazardous waste investigation was completed for the City and County of San Francisco by the consulting firm ERM-West. The potential presence of hazardous waste was discovered beneath the public right of ways adjacent to the subject property as a result of the ERM-West investigation. Based upon the results of the field investigation, a remedial action plan was proposed by ERM-West to mitigate conditions which would be encountered during construction in the

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public right of way.

Observations and photographs, made in the course of the construction project by the owner of the subject property and others, suggest that a large portion of the area excavated along Armstrong Avenue and Hawes Street was historically used for the indiscriminate dumping of solid waste, construction debris, waste oil and uncontained or drummed liquid chemical waste.

As a result of past indiscriminate disposal practices during the time period prior to site development in approximately 1955, and potentially as a result of subsequent subsurface construction activities, an area of floating product has come to be located on the groundwater table beneath the subject property in the area bounded by a portion of Hawes and Armstrong. The floating product is known to be composed of polycyclic aromatic hydrocarbons (PAHs), chlorinated hydrocarbons and aromatic hydrocarbons, but insufficient chemical analyses have been conducted in order to provide for full characterization of the waste.

In addition, review of photographs taken during construction of the YFOC project indicate that construction activities may potentially have contributed to the release of additional liquid waste into the substrate. Further, the backfill surrounding the concrete sewer and outfall is composed of porous material. This material facilitates rapid movement of contaminated groundwater and liquid contaminants. The lateral migration of contaminants within the backfill may contribute to spreading of contamination around the perimeter of the subject property.

Following completion of the project, the owner of the subject property, at his own initiative and expense, undertook to further investigate the source and possible magnitude of the subsurface contamination discovered in the process of construction of the YFOC Project. This report presents a review and assessment of data compiled by the property owner to date. In addition, data pertaining to the environmental and public health risks posed by chemical constituents present in the subsurface, to the extent ascertainable given the limited data, are discussed herein. Additional data, provided to Amen, Keith & Berg by the City and County of San Francisco subsequent to the date of completion of

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this report, has not been evaluated within the scope of the Phase I investigation.

1.1 Executive Summary

The property is underlain by artificial fill, younger bay mud, and bay side sand to the depth explored by geotechnical investigations. The artificial fill and younger bay mud are generally considered to be potentially subject to structural instability, and extensive engineering design is generally recommended for structures constructed in such material.

Groundwater is located at less than three to five feet beneath the subject property. Tidal fluctuations may affect the groundwater flow direction and gradient. In addition, an upward (vertical) hydraulic gradient may be present in the general vicinity of the subject property.

A substantial portion of the subject property appears to have been located bayward of the line of mean high tide prior to 1942. A potential minor discrepancy may exist between the delineation of the mean high tide line as surveyed by Allardt (1868) and the shoreline as delineated in historic aerial photographs. A document addressing legal problems associated with jurisdiction of tidelands and marshes is provided as an attachment to this report.

The U.S. Navy condemned and took possession of lands adjacent to the subject property for the purpose of constructing a railroad to the Hunters Point Naval Shipyard in 1942. Initial review of court documents suggests that public access bayward of the U.S. Navy railroad right of way was restricted during the 1940s and subsequent years. Review of aerial photography for the period 1939 - 1957 indicates that the portion of the subject property known to be underlain by contamination emerged from the bay prior to 1948. Aerial photographs from 1946 and 1948 appear to indicate that the contaminated area was characterized by a shallow depression, which appears to have been filled with debris and may have contained ponded liquid.

Access to the site appears to have been restricted to the railroad access road prior to 1948. In 1948 and subsequent years, access to the site may have been possible via one or more access points. By the time

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interval 1951-1953, the area of contamination was subject to final fill and grading operations.

Based on review of aerial photography, the areal extent of contamination may be greater than currently defined. In addition, additional sources of contamination may be present in close proximity to the subject property, including an area approximately located within the confines of property owned by the State of California.

Excavation activities associated with the YFOC project exposed considerable construction debris, scrap iron, military hardware, naval rigging and hospital waste, as well as buried drums, waste oil, and liquid chemical waste. A newspaper clipping obtained from the excavation area places an approximate time stamp of 1944 on fill activities in the area of contamination. A qualitative association can be surmised between waste discovered in the YFOC project area and similar areas currently subject to environmental cleanup at Hunters Point.

Subsurface investigations and chemical analyses of soil and groundwater performed by ERM-West for the City and County of San Francisco indicate that 1) a large area of floating product is located under a portion of the subject property and 2) potentially elevated concentrations of metals, degradation products of chlorinated aliphatic hydrocarbons (notably 1,1- and 1,2-dichloroethylene), PAHs, "waste oil", and benzene may be present beneath the property. Other laboratory analyses indicate concentrations of polychlorinated biphenyls (PCBs) may also be present beneath the subject property.

Photographic evidence suggests that construction activities associated with the YFOC Project may have contributed to the release and/or migration of contaminants into the subsurface adjacent to the subject property. In addition, the porous backfill of the sewer and outfall basin may provide for migration of contamination around the perimeter of the subject property, and may provide for an exposure pathway to aquatic life in South Basin, if any.

The data paucity does not allow for a detailed discussion of appropriate regulatory criteria and

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guidelines. Discussions provided herein do, however, delineate appropriate sections of Title 22, California Code of Regulations (CCR), and the Porter-Cologne Water Quality Control Act.

A preliminary assessment of risk is provided in Attachment E. The assessment indicates that a low probability of risk to the environment or human health may exist, provided that a substantial route of exposure is not present. The risk assessment is subject to considerable uncertainty due to the paucity of available and reproducible data.

2.0 PHYSICAL SETTING

As shown in Plate 1, the property is located within the South Basin area, an embayment of the San Francisco Bay located between Hunters Point and Candlestick Point in southeastern San Francisco.

A plot plan of the subject property, owned by Buckeye Properties, is presented in Plate 2. The property is bounded by a U.S. Navy Railroad right of way, and by Yosemite Avenue, Armstrong Avenue, Hawes Street, and Griffith Street. The South Basin Canal is located northeast of the property, beyond an extension of Yosemite Avenue. The property is transected on a diagonal by a former railroad right of way, historically reserved by the Tide Land Commission pursuant to Chapter 543 of the Statutes of 1868, and presently leased by Buckeye Properties from the State of California and/or the San Francisco Port Commission.

That portion of Yosemite Avenue which lies adjacent to the subject property, as well as the South Basin Canal and lands located southeast of Griffith Street, are within the Candlestick Point State Recreation Area (CPSRA), administered by the State of California Department of Parks and Recreation (CDPR). Map documentation presented in Appendix B of the "Candlestick Point State Recreation Area - General Plan" (CDMR, 1988) indicates that the South Basin Canal area of the CPSRA is to be used for wetlands restoration. The subject property is identified in CDMR (1988) as an area subject to potential acquisition by the CDMR for incorporation into the CPSRA.

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2.1 Zoning

As delineated in Figures 7 and 8-1 of the "San Francisco County Hazardous Waste Management Plan" (City and County of San Francisco Department of Planning, Draft Environmental Impact Report [SFDCP, Draft EIR] 1989), and Figure 13 of the "Environmental Impact Report - Yosemite Transport Storage Facilities" (City and County of San Francisco Department of Public Planning [Draft, 1983]), the site and immediately adjacent area are zoned for industrial (M-1 or M-2) use. The South Basin Canal, however, a portion of the public right of way, and the above referenced Tide Land Commission railroad right of way are zoned for public (P) use. Some nearby properties are zoned for residential (RM-1, RH-1) use.

2.2 Geology

Geologic and geotechnical conditions within the area of the Yosemite-Fitch Outfall Basin are presented in detail in "Geotechnical Investigation, Yosemite Fitch Outfalls Consolidation, City and County of San Francisco, California" (Geotechnical Consultants, Inc. [GTI], 1985) and the SFDCP Draft EIR (1988). A summary of the findings of the GTI (1985) report is provided herein.

San Francisco Bay and the alluvial and estuarine deposits in the South Basin area occupy a structurally controlled basin within the Coast Range Province. Pleistocene and Holocene sediments (less than 1.8 million years old) were deposited in this basin as it subsided (Atwater, Hedel, and Helley, 1977). In the South Basin area these sediments rest primarily on bedrock consisting of sandstone and shale of the Cretaceous (65 to 165 million years before present) Franciscan Formation (Caldwell-Gonzales-Kennedy-Tudor, 1982) and are locally overlain by artificial fill.

Subsurface conditions described in the GTI (1985) report for the Yosemite-Fitch Outfall Consolidation project were evaluated by a subsurface drilling program consisting of approximately 11 borings. The location of four of the borings, designated DH-3, DH-4, DH-9 and DH-10, are shown in Plate 2, Attachment A. Subsurface materials encountered during drilling include, in order of increasing depth beneath the subsurface, artificial fill (af), younger bay mud (Qyb), and bay side sand

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(Bbs). Cretaceous sandstone and shale (KJf) were encountered beneath the bay side sand in other portions of the Yosemite-Fitch Outfall Consolidation project area, but were not encountered to the depth explored beneath the subject property.

2.2.1 Artificial Fill

The veneer of artificial fill which covers the area is composed of a heterogeneous mixture of gravel and silty to clayey sand, with minor clay lenses. The artificial fill was encountered to a maximum elevation of approximately -11 feet (San Francisco City Datum [sfcd]) beneath the subject property. The site lies at an approximate elevation of -2 feet (sfcd). In addition to the above mentioned earth materials, the artificial fill is reported by GCI (1985) to contain wood, boulders, and large blocks of construction debris. The lithologic logs of borings indicate that Borings DH-4 and DH-10 both encountered oily material in the shallow subsurface.

Photographic evidence, obtained by the owner of the subject property during excavation and construction of the Yosemite-Fitch Outfall Project, indicates that artificial fill located along the property boundary beneath Hawes and Armstrong includes a considerable amount of material apparently derived from the World War II war effort, including significant amounts of ship rigging and cables, large quantities of stainless steel, canteens, hospital waste including bedpans, IV bottles, and empty pharmaceutical bottles, jeep tires, metal shop waste, railroad carts and waste, metal drums and containers occasionally containing a waste oil - like liquid, and large quantities of hot water heaters. Photographs of the sidewall of excavations indicates that voids within the fill are occasionally filled with a waste oil - like substance. A fragment of a newspaper obtained from a portion of the excavation is dated November 30, 1945.

Subsequent shallow drilling within the artificial fill was performed in late 1986 in the area of the Yosemite Fitch Outfall Consolidation project, by Environmental Resources Management-West (ERM-West), for evaluation of the presence or absence of contamination. The results of the ERM-West drilling program are presented in a subsequent section entitled "ERM-West Drilling

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Investigation (1986)".

2.2.2 Younger Bay Mud

The younger bay mud is reported to be a soft to medium stiff, compressible, gray-green to gray clay or silty clay with a Unified Soil Classification System (USCS) designation of CH. Local lenses of peat (PT), organic clay (OH), and sand (SC to SP) are also present. Thin discontinuous layers of sand, silt and shell fragments are reportedly present in the formation, which was encountered to elevations of approximately (-)22 to (-)30 feet (sfcd) beneath the artificial fill of the subject site, for a total approximate thickness of 11 to 19 feet.

2.2.3 Bay Side Sand

The Bay Side Sand is comprised of clayey to clean sand (SW, SP, SM and SC) that varies from green to brown-red and is medium dense to very dense. Local lenses of clay (CH) and sandy silt (ML) are also present. The sand is present below an elevation of (-)22 to (-) 30 feet (sfcd) beneath the subject property, and rests unconformably upon the Jurassic bedrock. The bedrock unit was not encountered beneath the subject property to the maximum depth drilled, approximately (-) 60 feet (sfcd).

2.3 Hydrogeology

A groundwater contour map of the South Basin area is presented in Plate 3, Attachment A (City and County of San Francisco Department of City Planning, 1989, referencing others). Groundwater flow within the area of the subject property appears to be directed northward, towards the South Basin channel. The lobate shape of the groundwater contour map southeast of the subject property appears to reflect the presence of a shallow bedrock ridge within the area.

The GCI (1985) report indicates that the groundwater level recorded in a piezometer screened between depths of 7 and 18 feet within the artificial fill was at an approximate elevation of (-)5.5 feet (sfcd) in August, 1984. By contrast, a piezometer screened within the bay side sand between depths of 39 to 59 feet recorded a groundwater elevation of (-) 2.5 feet (sfcd).

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Consequently, groundwater flow at depth appears to occur under semiconfined to confined conditions, and an upward groundwater flow component may be inferred. An approximate upward vertical gradient of 0.08 feet per foot may be inferred for the data provided in GCI (1985).

The GCI (1985) report further indicates that one well, located approximately 500 feet from the South Basin canal, was equipped with a continuous water level recorder to record fluctuations in the static groundwater table due to tidal variations. No significant tidal influence was recorded. The report indicates, however, that fluctuations may occur closer to the South Basin (Yosemite) Canal.

2.4 Seismicity

As discussed in the SFDGP Draft EIR (1988), three active faults located within the immediate San Francisco area are capable of producing a major earthquake. These are the San Andreas, Hayward and Calaveras Faults. All three are associated with the northwest trending San Andreas fault system. The San Andreas is the nearest recognized active fault to the southeast area of San Francisco, at a distance of approximately nine miles to the southwest. The Hayward and Calaveras Faults are approximately 11 miles and 23 miles to the east of the site, respectively.

Seismic hazards associated with a major earthquake on any of the active Bay Area faults that would potentially impact the area of the subject property include: ground shaking, subsidence, liquefaction, tsunami, and reservoir failure and inundation (flooding) (Draft EIR, 1988).

2.5 Soil Stability

It is generally recognized (Nichols and Wright, U.S.G.S., 1971) that the physical properties of marshlands and tideland sediments in general, including the high water content (generally more than 50 % by weight); the low bearing strength; the high compressibility (especially where containing peat deposits); the moderately high sensitivity; and, in some areas, a high shrink-swell ratio, constitute factors that must be considered in the exploration, testing

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design, and construction of engineering projects on younger bay mud. These properties, along with the varying thickness and grain size over relatively short distances, can result in marked local differential and regional settlement and in slope instability when loads are imposed on settlements.

Review of site conditions and interviews with the owner of the subject property suggest that construction of the Yosemite Fitch Outfall structures may have negatively impacted the structural stability of the subject property. Indications of settlement along Hawes Street are especially noticeable, including areas of localized subsidence, structural offsets within buildings, soil rupture and cracking or tilting of concrete foundations. However, a detailed review of preconstruction geotechnical reports, and review and study of as built conditions of the outfall structures and associated evaluation of potential structural damage to the property is beyond the scope of this report.

2.6 Tidal Information

As shown in Plate 12 of CDPR (1988), tidal information published by the U.S. Department of Commerce National Oceanic Survey - May, 1977 provides the following datum for tidal levels:

- Mean higher high water - 6.6 feet
- Mean high water - 6.0 feet
- Mean tidal level - 3.5 feet
- Mean lower low water - 0.0 feet
- Extreme low water - (-) 2.5 feet

The datum is not given. It is inferred that the elevations are presented relative to mean sea level, U.S. Coast and Geodetic Survey datum of 1929.

3.0 HISTORY OF SOUTH BASIN

A detailed history of land use and development within the subject area is provided in Dow (1973). Most of the land underlying the area landward of the subject property was reclaimed from San Francisco Bay during the latter half of the 19th century (Dow, 1973). The subject property and other nearby lands within the approximate area of the Yosemite Fitch Outfall Consolidation Project were reclaimed from San Francisco

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Bay by the middle of the 20th century. According to Dow (1973), prior to filling, the area lying southwest of Hunters Point "was a pleasant basin-like valley ..." with a "crescent-shaped shoreline ... indented with small coves and tiny beaches."

3.1 Tideland Survey

The tidelands of the area southwest of Hunters Point were surveyed by George Allardt in 1868 for the State Tide Land Commissioners, who then sold them to private parties. According to Dow (1973), the "offshore submerged lands" southwest of Hunters Point "were the most extensive to be surveyed and sold in San Francisco by the state. The cove containing these submerged lands was named South Basin and it was here that most of the fill took place." Further,

"Here...more than any other point of San Francisco bay fill occurred with the least notice. It began as early as 1863 and continues today. Unfortunately, the record is either unclear or totally silent on many of the particulars. Even today (1972), with government's many bureaus...and all the hearings, administrative approvals, permits, rules and regulations regarding filling of San Francisco Bay, unauthorized fill continues at South Basin. ...The City and County of San Francisco is aware of the unauthorized fill being placed at South Basin as is the San Francisco Bay Conservation and Development Commission; in fact, the B.C.D.C. has several lawsuits pending against the City of San Francisco regarding this fill."

3.1.1 Historic Shoreline

Several datum exist which delineate historic shorelines. Dow (1973) references an 1859 shoreline survey (U.S. Coast Survey Chart No. 621). Geotechnical Consultants, Inc. (1985), referencing Dow (1973), provide a figure (Figure 2 - Historic Shoreline) showing the location of what is referenced as an 1849 shoreline. The figure indicates that the subject property was located primarily bayward of the shoreline. Nichols and Wright (USGS, 1971) reference the U.S. Coast and Geodetic Survey of 1852 for the Scale 1:125,000 "Preliminary Map

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of Historic Margins of Marshland, San Francisco Bay, California". Given the limitations of scale, this map also appears to indicate that the property was located outside (bayward) of the outer edge of marsh, which normally may be defined as "mean high water", although technical limitations to an exact definition of "mean high water" may exist (USGS, 1971). The U.S. Coast and Geodetic Survey Map of 1942, shown in Plate 3, Attachment A, likewise indicates that the subject property was located primarily bayward of the outer edge of marsh. The above referenced map by Allardt (1868), however, surveyed for the State Tide Land Commission, identifies an "Ordinary High Tide Line" which transects a substantial portion of the subject property approximately 100 feet northwest of the present location of Hawes Street. This latter survey has historically and legally served as the basis for most maps of lands situated in the South Basin area.

3.2 Site History (Mason Tillman Associates, 1986)

A site history report for the subject property has been previously prepared by Mason Tillman Associates (June, 1986). As discussed in the report,

"The Ricci and Kruse Lumber Company has been in the retail business selling various types of woods and related materials on the project site since the mid 1950s. Research failed to disclose any operation on this site by Ricci and Kruse Lumber Company which would have created or produced hazardous wastes.

"The project site was acquired by Ricci and Kruse Lumber Company immediately after the land was brought above water. The lumber company used red rock fill to further raise the land level along the perimeters of the project site, ultimately bringing the entire project site to the original shore line. Ricci and Kruse have been the sole and only occupants of the property since it was filled above the water level."

Subsequent discussion in the Mason Tillman (1986) report indicates that there were activities in the immediate vicinity of the project site and at greater distances, which could "possibly present an issue of

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contamination." Possible sources of contamination were inferred to include the Lucatex Paint, Inc. site and the Pacific Construction Company, as well as the Hunters Point Naval Shipyard. However, based upon the limited amount of evidence, Mason Tillman (1986) concluded that it was highly unlikely that any of the referenced sites would have contaminated the project area.

It is noted that the findings of the Mason Tillman Associates (1986) report concerning 1) development and occupation of the subject property, and 2) the potential for on site contamination from an off site source, were based upon limited sources of information. The review of aerial photography, presented below, does not substantiate these findings.

4.0 HUNTERS POINT NAVAL SHIPYARD

The impact wartime operations during World War II on the South Basin area appears to have been significant, primarily due to the proximity of the basin to Hunters Point Naval Shipyard. Within two years after commencement of the United State's involvement in the war, Hunters Point was transformed into a vast naval complex for maintenance of the Pacific Fleet (Dow, 1973). Operations at Hunters Point spilled over into the South Basin area as the U.S. government laid claim to portions of the basin through a series of land condemnations in accordance with the provisions of the Lanham Act.

The greatest extent of fill operations at South Basin occurred during and immediately following World War II. The largest area to be filled, the former marshland located landward of mean high water as delineated in Nichols and Wright (U.S.G.S., 1971), resulted from a need to provide temporary war housing for the workers at Hunters Point Naval Shipyard (Dow, 1973). Changes which occurred during the period of the war and the post war period were not recorded by the U.S. Coast and Geodetic Survey until 1957 (Dow, 1973).

4.1 History of Land Condemnation in South Basin (1942-1957)

During the wartime emergency, some privately owned lands in and adjacent to South Basin and Hunters Point were secured by the federal government in a series of

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condemnations under the conditions of the Lanham Act (Dow, 1973), and under these terms the government was allowed to take possession of land before title had passed.

According to Dow (1973) and verified by partial review of the court records, clear title to some small landholdings belonging to private individuals was not passed until years after the end of World War II. The owner of the subject property has indicated that in some instances, payment to private individuals may have been made for property which evidently was not in the individual's possession, and/or did not exist. Several cases of land disputes resulting from the land condemnations were resolved as late as 1957. Dow (1973) indicates that as late as 1972, litigation proceedings were still in process between the San Francisco Port Authority (formerly the State Board of Harbor Commissioners) and the United States government over title settlement of some condemned public lands.

Impact of Condemnations on Subject Property

Sufficient evidence is present to suggest that a portion of Block 4846 contiguous with the subject property (Plate 2) was acquired in 1942 by the United States for "use in connection with the construction, maintenance and operation of the access railroad, Hunter's Point, California" (Quotation from Docket No. 22197-W, Lis Pendens, District Court of the United States in and for the Northern District of California, Southern Division, recorded June 3, 1942 [Lis Pendens does not appear to include the subject property]).

The location of the railroad right of way is shown in Plate 1 and Plate 5. The position of the subject property and railroad as shown in Plate 5 is approximate, and intended for illustrative purposes only.

Several similar condemnation actions were filed against the State of California and the City and County of San Francisco, and other parties, restricting the rights of public transport in certain areas and restricting points of access to areas located bayward of the approximate line of the Hunters Point railroad right of way. Most properties bayward of the right of way were condemned by the Navy, excepting those industrial properties which

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were deemed necessary for the war effort. Although the available record is fragmentary and incomplete, initial review of the documentation suggests that the area of the subject property and much of the South Basin area bayward of the railroad right of way may have been effectively isolated from all but U.S. Government activity, subject, however, to public utility easements or other restrictions.

The record of property condemnation for the subject property has not yet been made available, and may not exist. It has been suggested by the current owner of the subject property that a condemnation action may not have been required because the subject property may have been located bayward of the high water mark, and consequently may have been subject to the provisions of an act of the legislature of the State of California entitled "An Act relinquishing to the United States of America the title of this State to certain lands [approved March 9, 1897]" (Statutes of California, Thirty-second session, Chapter LXXXI).

The applicability of the referenced act is a subject for legal interpretation, and is not evaluated herein. A brief evaluation of legal problems associated with tidelands and marshes is presented in Briscoe (1979), provided for review in Attachment C.

4.2 Hazardous Waste Sites at Hunters Point and Nearby Lands

During the war and immediate post war period, much of the historic bay margin in South Basin was apparently subjected to considerable fill and dumping operations, either by the U.S. Government, its contractors, or private individuals following cessation of the war emergency. The use of the bay margin as a fill area appears, by present day standards, to have been indiscriminate, both within and outside the boundaries of the Naval Reserve at Hunters Point.

The following summary of the hazardous waste sources at Hunters Point and the vicinity is taken from "The Navy's Environmental Cleanup of Hunters Point", a brief publication available at the Information Repository of the San Francisco Public Library (Hunters Point Community Relations Program, undated), as well as other documentation present at the repository.

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The Hunters Point Annex was operated as a commercial drydock facility from 1869 until it was purchased by the U.S. Navy in 1939. Following the purchase, the facility was leased to Bethlehem Steel Company. The Navy operated Hunters Point as a shipbuilding and repair facility from 1941 to 1976. At its peak, Hunters Point Naval Shipyard employed 17,000 people. In 1976, most of the shipyard was leased to Triple A Machine Shop, Inc., which operated the shipyard as a commercial ship repair facility until June 1986.

Hunters Point Annex has seen continual heavy industrial use for the past 120 years. These uses generated large amounts of industrial wastes. Wastes generated included solvents used to clean parts, acids and caustics used in fabrication of parts and sand blast waste, waste oil, waste acids, cyanide wastes, chromates and heavy metals, PCBs, unclassified chemical wastes, radioactive waste, and asbestos.

Between 1958 and 1974, the Navy used an industrial landfill (IR-1, Plate 5) to dispose of industrial wastes at Hunters Point. The Navy as well as other land users disposed of hazardous waste at other sites throughout the annex. Extensive environmental investigations at the annex have resulted in the identification of 11 hazardous waste sites at the facility. Preliminary investigations have begun at seven additional sites where contamination may have occurred.

Six of the known sites of contamination are located in close proximity to the above referenced Navy railroad right of way and access road. As shown on Plate 5, these include 1) the former industrial landfill located in a filled portion of South Basin (IR-1), 2) the Bay Fill Area, also located on land reclaimed from the bay (IR-2), 3) Oil Reclamation Ponds (IR-3), 4) the Scrap Yard (IR-4), 5) the Old Transformer Storage Yard (IR-5), and 6) the Pickling and Plate Yard (IR-9).

4.2.1 Industrial Landfill (IR-1)

It is reported (Regional Water Quality Control Board [RWQCB], 1987) that from approximately 1958 to 1974, the Navy disposed of industrial and solid wastes along the west shore of the shipyard. Wastes included building construction and demolition wastes, domestic waste and refuse, dredge spoil materials, sand blast waste, shop

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industrial and chemical waste, solvents, solid and liquid ship repair waste, and low level radioactive waste (from shipboard radium dials and electronics equipment).

4.2.2 Bay Fill Area (IR-2)

From 1945 to 1978, the southwest Bay shore area was a site used for disposal of sand blast waste (sand aggregate, steel, copper, lead, rust and lead based paint scrapings), chemicals and waste oil.

4.2.3 Oil Reclamation Ponds (IR-3)

From 1944 to 1974, Hunters Point Naval Shipyard operated a waste oil reclamation system which used two man made unlined ponds for oil storage. The Initial Assessment Study (IAS) for HPNS determined that solvents, caustic sodas, ethylene glycol and chromates were also disposed of in these ponds.

4.2.4 Scrap Yard (IR-4)

From 1954 to 1974, submarine battery lead and copper, along with used electrical capacitors (containing PCBs) were crushed and stored at this site.

4.2.5 Old Transformer Storage Yard (IR-5)

From 1946 to 1974, used electrical transformers (containing PCBs) were crushed and stored at this site.

4.2.6 Pickling and Plate Yard (IR-9)

From 1947 to 1973, the Navy utilized three acid storage tanks, three brick lined pits for dipping large steel plates, and an open storage rack used for spraying steel plates with zinc chromate.

4.3 Impact to Human Health

According to available documentation, no immediate threat to human health is apparent based upon the results of subsurface investigations. A detailed evaluation of the impact of contamination at Hunters Point will not be available until completion of the Public Health and Environmental Evaluation (PHEE).

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5.0 SITE AERIAL PHOTOGRAPHIC SURVEY, 1939 - 1957

Aerial photography from the period 1939 to 1957, compiled by the owner of the subject property and received from Amen, Keith & Berg, was reviewed to provide information regarding past conditions and land uses at the subject site and in the immediate vicinity. A tabulation of the photograph compilation is provided in Table 1, Attachment B. Portions of six of the photographs have been reproduced as Plates 6 through 11, Attachment A, for purposes of discussion.

5.1 Photograph DDB-2B-124 (10-11-43)

Early aerial photographs from the period 1939 - 1943 indicate that the subject property was primarily submerged. Photograph DDB-2B-124 (10-11-43), shown in Plate 6, indicates that a large portion of the marshlands adjacent to South Basin - later filled in for provision of temporary, prefabricated housing for the Hunters Point work force - was still intact. Fill operations and apparent construction activities are observable along the U.S. Navy right of way, acquired for the purpose of constructing a Navy railroad and access highway. The fill area extends across that portion of land located adjacent to the subject property which had been subject to an apparent condemnation action in approximately 1942. The source of fill in part appears to have been a large hill located east of South Basin. Excavation cuts are observable on the hillside.

The pre-1942 shoreline - derived from superposition of the U.S. Coast and Geodetic Survey of 1942 on the photograph - is largely intact in the area of the subject property, with the exception of the aforementioned fill area. A railroad yard is present adjacent to the subject property. The yard was owned by A.D. Schraeder, a contractor who assisted in construction of the railroad to Hunters Point.

The approximate areal extent of contamination on and adjacent to the subject property, delineated by drilling operations conducted in 1986 by ERM-West, is also superimposed on the photograph. The areal extent of contamination is roughly coincident with an area located adjacent to a portion of the A.D. Schraeder property boundary which abuts against the bay margin. There is

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no indication of any substantial fill operation in the area of known contamination.

Examination of the Hunters Point area shows early development in source area IR-2 (Hunters Point Community Relations Program documentation). Fill operations in this area had reclaimed substantial portions of land from the bay by 1943.

Review of a subsequent photograph titled "Uncontrolled Mosaic of Hunter's Point - Utility Squadron One" (March 30, 1945), not reproduced herein, indicates that the marsh area formerly located landward of the subject property had been completely reclaimed and developed as housing for Hunters Point personnel. Approximately half of that portion of the property located within the area defined by the Navy railroad right of way, Armstrong and Yosemite Avenues, and Hawes Street had been filled. The scale of the photograph does not allow for detailed inspection of the fill material.

5.2 Photograph 2-87 GS-CP (7-29-46)

Examination of this photograph illustrates that a substantial portion of the subject property had been filled, including the area of known contamination and most of the area inclusive of Hawes Street and Yosemite and Armstrong Avenues. Despite the poor definition of the photograph, features observable within the subject property include 1) an apparent access route for traffic oriented parallel to the South Basin Canal, 2) a large area of dark staining which includes a portion of the area of known contamination, and 3) an apparent runoff channel situated between the boundary of the A.D. Schraeder yard and the subject property.

Several source areas for contamination at Hunters Point are also evident on the photograph, including the aforementioned bay fill area (IR-2), early fill operations in the area of the industrial landfill (IR-1), oil reclamation ponds (IR-3), a scrapyard (IR-4) and a transformer storage yard (IR-5).

5.3 Photograph AV-17-12-15 (7-28-48)

The resolution of the 1948 photograph allows for close inspection of the subject property and vicinity. A route of ingress and egress to and from the property is

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observable. Two trucks are observed in the process of leaving the site. The large area of dark staining, visible on the above referenced photograph and roughly coincident with the area of known contamination, appears to be full of debris and material, including items such as lifeboats and rafts, and wood or metal scrap. An enlargement of the subject property area, not reproduced herein, was also examined. Examination of the enlargement appears to indicate that a depression may have been present in the area of known contamination. Material or liquid within the depression is highly reflective, or shows a distinct mottling and/or interplay of alternately highly light absorbing and light reflecting liquid or material. A partially filled, dark stained runoff channel is also visible. Drainage of the channel to the bay appears to be obstructed by a mound of fill.

5.4 Photograph 4VV5RTM 2128 5SRG (1-30-51)

Examination of this photograph suggests that a substantial increase in fill activities occurred in the South Basin Channel area between 1948 and 1951. The fill area northeast of the subject property on the opposite side of the channel had been considerably expanded, and fill areas appear graded. Soil stockpiles are also present, suggestive of final filling and grading activities.

The subject property likewise shows signs of filling and grading, although activities appear to have been preliminary in scope. The area of known contamination, formerly an apparent depression, appears to have been filled to approximate grade. Fill and dumping activities appear to be concentrated in an area in closer proximity to the present position of Griffith. A burn area and an apparent pit are observable outside the approximate limit of the subject property. The location of the pit is roughly coincident with a portion of the area presently defined by the intersection of Armstrong Avenue (extension) with the above referenced Tide Land Commission railroad right of way, presently zoned for public use, and apparently owned by the city.

5.5 Photograph VV 302 TRS M 553 TAC 10 FEB 53 302/60 S-24 (2-10-53)

Examination of the subject property indicates that the

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portion of the property adjacent to the Navy railroad, including the area of known contamination, had been filled to grade and graded. Two apparent fenced enclosures are present. Routes of ingress and egress to and from the property are well defined. The area southeast of the present location of Hawes Street is occupied by several automobiles. The above referenced pit was still present on the adjacent property.

The photograph also shows the significant expansion of the Hunters Point complex which occurred in the early 1950s. The location of several of the Hunters Point source areas are indicated on the photograph.

5.6 Photograph AV 170 08 14 (5/5/55)

As seen on the photograph, the subject property had been completely filled and graded. The lumberyard which subsequently occupied the site is under construction. There is no visible evidence of contamination. An apparent storage area or junk yard for automobiles is located adjacent to the subject property.

5.7 Subsequent Aerial Photography (1957)

An aerial photograph derived from Gabriel Moulin Studios (negative number 14117-2, dated 9-12-57), not reproduced herein, provides an oblique view of the operating lumberyard. Two structures and stockpiled lumber are observable. The structures appear to be warehouses used for the delivery and storage of lumber. No processing operations are discernable. Adjacent property across Armstrong Avenue (extension) appears recently graded. Some refuse, and an area of discoloration, are observable along the bay margin outside the area of the subject property. The former Yosemite Pumping station is also visible in the photograph.

5.8 Site Accessibility

To the extent permissible given limitations of scale and clarity of the aerial photographs, it may be qualitatively observed that access to the site from various directions, including Hunters Point Naval Shipyard and the associated industrial area, as well as other avenues and thoroughfares apparently not connected to Hunters Point, changed through the time period under examination (1939 - 1957).

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In 1943, the site was primarily under water and fill operations had only recently been completed for construction of the railroad spur and access road. Examination of the 1946 photograph indicates that access to the property was apparently restricted to the Navy railroad right of way and access road. By 1948, however, access to the site appears to have been available via both Armstrong Avenue and the Navy access road. The Armstrong Avenue ingress appears heavily travelled in the 1951 photograph, with subordinate indications of transport along the Hunters Point road. Dual access is again apparent in the 1953 photograph and, with significant fill operations commencing elsewhere along South Basin, the Hunters Point railroad access route appears more heavily travelled than in 1951. By 1955, several access routes to the entire South Basin area appear to have been established.

5.9 Summary of Aerial Photography

The subject property appears to have been under water until approximately 1943. The subject property emerged from the bay in 1945-1946 and was gradually filled until 1957. Within the approximate confines of the area of known contamination beneath the subject property, no visible indications of environmental contamination appear to be identifiable in the aerial photographs dated from 1951 onward.

To the extent ascertainable, fill operations which resulted in early emergence of that portion of the subject property which is underlain by the known extent of contamination may have been associated with operations at Hunters Point. It is noted that access to the site, located bayward of the Navy railroad right of way and access road, appears to have been restricted until approximately 1946 - 1948. As discussed in a previous section, the contents of the artificial fill, including significant amounts of ship rigging and cables, large quantities of stainless steel, canteens, hospital waste including bedpans, IV bottles, and empty pharmaceutical bottles, jeep tires, metal shop waste, railroad carts and waste, metal drums and containers occasionally containing a waste oil - like liquid, and large quantities of hot water heaters, suggests that the early fill operations derived material from the naval operations at Hunters Point.

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By 1948, however, access to the site appears to have been available from several sources, and post-1948 photographs suggest a significant amount of transport to the site occurred along roadways other than the Hunters Point railroad access road. Source areas apparently located outside the area of the subject property, identified from aerial photography of the early 1950s, may consequently have been derived from the activities of unidentified parties.

Pertaining to the known extent of subsurface contamination, as ascertained from the exploratory work performed by ERM-West (discussed below), it appears that the configuration of a portion of the contamination plume closely approximates the former border of the A.D. Schraeder railroad yard. Review of oblique and overhead aerial photography suggests the area adjacent to the A.D. Schraeder fence line may have been characterized by a large depression of irregular morphology and topography, which may have extended up to 100 feet into the subject property. Dark staining observable on several photographs suggests that additional contamination may be present beneath the subject property in the vicinity of the area of known contamination. It is further noted that an apparent runoff channel appears to have been situated between the boundary of the A.D. Schraeder yard and the subject property, and may have contributed to discharges of liquid to the bay.

6.0 EXTENT OF SEWER UTILITIES PRIOR TO 1987

The construction and operation of sewer utilities prior to 1987 may potentially have contributed to the presence and/or migration of contamination beneath the subject property. Two sewer facilities were previously located in the vicinity of the subject property. The Yosemite Pumping station was previously located near the head of the South Basin Canal, at the intersection of Ingalls Street and Yosemite Avenue (Plate 12). The sewer apparently discharged treated effluent to the South Basin Canal, located adjacent to the subject property. In 1966, a sewer lateral was constructed along Armstrong Avenue by McGuire and Hester, contractor for the City and County of San Francisco.

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6.1 Discharges by Southeast San Francisco POTW

A table of average effluent concentrations from the 1982 NPDES Compliance Monitoring Reports for the San Francisco - Southeast Publicly Owned Treatment Works (POTW), presented in "Toxics in the Bay" (Citizens for a Better Environment, Report 83860, December 19, 1983), indicates that significant quantities of metals, phenols, and oil and grease were discharged as final treated effluent to the Bay from the southeast POTW.

6.2 Construction of 1966 Sewer Lateral

The location of the 1966 sewer lateral is shown in Plate 12, Attachment A. The approximate known extent of contamination beneath and adjacent to the subject property (modified from ERM-West, 1987) is superposed on the construction plan for the sewer lateral (City and County of San Francisco, 1966). Although the exact depth of construction of the sewer is not known, it is likely that the sewer and backfill material intercepted the subsurface contamination and, consequently, the presence of the sewer may have provided for potential lateral migration of the subsurface contaminant plume along Armstrong Avenue.

7.0 YFOC PROJECT INVESTIGATION (ERM-WEST, 1987)

As shown in the construction plan of Plate 13, Attachment A, the YFOC project in the vicinity of the subject property included construction of a 66-inch diameter sewer along Armstrong Avenue, and construction of a 17 to 40 foot wide outfall basin along Hawes Street, Yosemite Avenue and across the Yosemite (South Basin) Canal. Plans presented in GCI (1985) indicate that the base of the 66-inch diameter sewer constructed along Armstrong was to be placed at an approximate elevation of (-)23 feet (sfcd). The same plans indicate that the outfall basin was to be placed at an approximate depth of (-)26 feet (sfcd). As built plans for the YFOC project have not been obtained in the course of this investigation.

The consulting firm ERM-West was retained by the City and County of San Francisco to evaluate the presence or absence of contamination in the area of proposed construction for the YFOC project. In the area of the subject property, the ERM-West investigation was

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primarily concentrated along Armstrong Avenue and Hawes Street. Minor subsurface exploration occurred on Yosemite Avenue. The following summary of the ERM-West investigation is taken from Baseline Environmental Consulting (1987).

ERM-West collected soil and groundwater samples for the city in November, 1986. Sampling locations are shown in Plate 14, Attachment A. Seven boring locations are located on Armstrong Avenue and four boring locations are located on Hawes Street. Two boring locations are present on Yosemite Avenue. Three monitoring wells, designated OW-1, OW-2 and OW-3, were also installed on or near the subject property. Data submitted to the city by ERM West are, as stated in the Baseline (1987) report, "incomplete and inconclusive as to the location and source of compounds identified in the subsurface". Analyses were performed on soil and groundwater samples from locations 7, 7A, 8 and I. In addition, the Baseline (1987) report indicates that, according to verbal communication with ERM-West staff, soil borings along Armstrong Avenue were not sampled, but rather were visually examined for soil discoloration and floating product on the groundwater table.

7.1 Analytical Results

Analytical results from the ERM-West (1987, 1987a, 1987b) reports are summarized in Tables 2 and 3 of Attachment B, for Borings 7A and 8. The analytical data for Boring I has not been compiled due to apparent inconsistencies observed in the data. In addition, analytical data is reported to be available for Borings T, W, and Wells OW-1, OW-2 and OW-3 (Baseline, 1987). The latter data has been requested from the City and County of San Francisco by Amen, Keith & Berg, but had not been received prior to compilation.

7.1.1 Data Validity

Some of the analytical data presented in the available ERM-West documents appears to have been generated from composite samples. The compositing appears to have occurred under uncontrolled field conditions. Further, sample chain of custody documentation and a detailed description of sampling protocol are not available.

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7.1.2 Soil Analytical Data

The analytical results indicate that soil contamination by organic compounds has occurred in the subsurface at Location 7A, with Total Petroleum Hydrocarbon (TPH) concentrations in soil of 680 milligrams per kilogram (mg/kg), or parts per million (ppm). A sample of "black ooze", which may be assumed to be a portion of the floating product, collected at location 7 was analyzed for creosote and pentachlorophenol. These constituents were not detected above the instrument detection limit of 10 mg/kg.

Soil samples from locations 7 and 8 were also collected and analyzed for metal inorganic constituents. Potentially elevated concentrations of several metal constituents were detected. The zinc concentration exceeds the California Code of Regulations (CCR) Title 22 Total Threshold Limit Concentration (TTLC) criteria for designation as a hazardous waste.

7.1.3 Groundwater Analytical Data

Water from the open borehole of 7A was sampled and analyzed for benzene, toluene, ethylbenzene and xylene (BTXE), chlorinated aliphatic hydrocarbons (purgeable halocarbons), and polycyclic aromatic hydrocarbons (PAHs). Total PAHs were present in concentrations of 8.35 milligrams per liter (mg/l), or ppm. Benzene, toluene, xylene and 1,1 dichloroethene (1,1-DCE) were also detected.

Groundwater samples collected at well locations OW-1, OW-2 and OW-3 (Plate 14) were analyzed for TPH, PNAs and polychlorinated biphenyls (PCBs) (at location OW-3). According to Baseline (1987), the highest concentrations of TPH and PNAs were detected at OW-3. PCBs were apparently not detected above the instrument level of detection.

7.2 Extent of Contamination Defined by ERM-West

Based upon organoleptic and analytical indications of contamination, ERM-West delineated the area of approximate contamination present in the area of Armstrong Avenue and Hawes Street as shown in Plate 15. Additional areas of contamination may be inferred outside the area. For example, review of ERM-West

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drilling logs indicates that organoleptic indications of contamination were apparently detected during drilling of Boring D, approximately located as shown in Plate 14.

8.0 ADDITIONAL ANALYTICAL RESULTS

Baseline Environmental Consulting collected soil samples at Brush Lumber Company, located at the former A.D. Schraeder property across Armstrong Avenue from the subject property. Samples were analyzed for TPH, PAHs and creosote. TPH concentrations ranging from 83 to 180 ppm were detected in three of the ten locations sampled. Total PAH concentrations ranged from <0.1 to 2.2 ppm. Creosote concentrations were apparently not detected. According to Baseline (1987), an underground storage tank was formerly located at the Brush Lumber property. An unauthorized release was detected during closure activities and a monitoring well was installed by the contractor. No compounds were detected in a groundwater sample collected by the contractor and submitted for analysis of BTXE.

8.1 Monitoring Well OW-3

At the request of the owner of the subject property, a sample of liquid from Well OW-3 was collected and submitted to Precision Analytical Laboratory, Inc. by L&W Environmental in June, 1989. The sample was analyzed for PCBs, halogenated hydrocarbons and metals. The Certified Analytical Report is presented in Attachment D. PCBs were detected at 3.7 ppm, reported in mg/kg. Halogenated hydrocarbons were not detected. Detectable levels of antimony, zinc, lead, cobalt, copper, nickel, chromium, vanadium, copper and barium were also present in the sample.

9.0 DOCUMENTATION AND IMPACT OF CONSTRUCTION ACTIVITIES

Review of photographs taken during construction of the YFOC project document that significant indications of contamination were encountered during excavation along Armstrong and Hawes. In addition to the inventory of military hardware, construction debris, hospital waste, scrap metal and drill cuttings, stainless steel and railroad material noted in a previous section, photographs show 1) liquid waste draining from voids within the artificial fill following excavation, 2) metal drums, crushed or cut during excavation, draining

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liquid waste, and 3) apparent commingling of floating product(s) within the submerged trench excavation.

According to the owner of the subject property, initial efforts to remove contamination prior to construction included a groundwater extraction program. Due to the fine grained nature of the artificial fill and younger bay mud, the effort was largely unsuccessful. Contaminated soil was therefore excavated and stockpiled on plastic. Contaminated groundwater was apparently pumped to large capacity Baker tanks from two wells located along Armstrong Avenue.

The owner of the subject property has indicated that the project encountered considerable delays due to the contamination problem. During later phases of construction, proper waste handling protocol may have been circumvented in the interest of meeting the demands of the construction budget and schedule. Circumvention of protocol included pumping of contaminated groundwater directly to the sewer, as observed in available photographic documentation, and installation of the sewer conduit directly into floating product and contaminated groundwater, followed by backfilling operations. During a subsequent construction phase involving installation of catch basin near the intersection of Hawes Street and Armstrong Avenue, a large metal container filled with a waste oil like product was breached but left in place.

To the extent, arguendo, that the remediation activities may have mitigated contamination present in the subsurface of the public right of way, one can not conclude that the subject property was not negatively impacted by subsequent construction of the sewer and associated backfill. It is apparent that construction activities clearly contributed to the release of additional contaminants into the substrate. Further, the backfill surrounding the concrete culvert is composed of porous material with an inferred high hydraulic transmissivity. It is noted that ERM-West recommended construction of baffles within the porous backfill to inhibit lateral transport of contamination. Photographs of backfilling operations indicate that this recommendation was not implemented. Consequently, lateral migration of contaminants within the backfill may potentially occur, allowing for a substantial increase in the probability for accelerated migration

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and dispersion of contaminants along the perimeter of the property by advective transport and other contaminant transport processes.

10.0 REGULATORY CRITERIA

The limited data available for the subject facility precludes detailed discussion and comparison of contaminant levels with applicable regulatory rules, regulations, guidelines and advisories. A brief overview is provided herein.

10.1 Regulatory Rules

A discussion of regulations contained within the federal hazardous waste regulations including the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA) is beyond the scope of this document. With reference to the Superfund legislation, it is noted that Superfund provides for strict, joint and several liability among responsible parties who can be required to finance cleanup activities. It is also noted that 1) the EPA has applied provisions of the law to allow responsible parties who made only minor contributions to contamination to sign de minimus settlements under which they agree to contribute a small, fixed amount to cleanup costs. On May 30, 1989, EPA also formalized arbitration procedures for allocating response and cleanup costs when total costs do not exceed \$500,000.

Review of the available data suggests that a discussion is appropriate concerning regulatory rules contained within CCR Title 22, pertaining to hazardous waste criteria, and the Porter Cologne Water Quality Control Act, pertaining to discharges to waters of the state.

10.1.1 CCR Title 22

Future investigative and remedial activities at the subject property will require careful adherence and review of hazardous waste regulations contained within CCR Title 22. Fundamental definitions of what constitutes a hazardous waste, as set forth under Articles 9 and 11 of CCR Title 22, and the applicability of such criteria as cited under Article 2, should be

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adhered to for declassification of any waste as nonhazardous. Pursuant to 22 CCR, Section 66300 (a) (1), any waste determined to be hazardous according to any of the criterion in Article 11 and consists of or contains a material cited under Article 9 shall be handled as a hazardous waste.

10.1.2 Porter Cologne Water Quality Act

Following review by legal counsel of the provisions set forth in Sections 13271 and 13272 of the Porter Cologne Water Quality Control Act, appropriate further notification may be provided by appropriate parties to the RWQCB and initial notification should be provided to the Office of Emergency Services.

The RWQCB may eventually require monitoring and investigation of site conditions in accordance with Water Code Section 13267 (a) and (b). Further requirements may be ordered in accordance with Section 13304, in the event that the conditions under which Section 13304 may be implemented are germane to the site.

10.2 Comparison of Data to Applicable and Relevant Standards

The paucity and questionable veracity of available data places severe constraints on relevant opinion and commentary. Review of the highly limited chemical data suggests that a low probability exists that observed concentration levels of some site soil and groundwater constituents may exceed some applicable and relevant standards pertaining to hazardous waste criteria, permissible exposure levels or ambient water quality criteria. One observed concentration of zinc, for example, exceeded the TTLC value for designation as a hazardous waste.

Preliminary review suggests that DCE, benzene, PCBs, benzo[a]pyrene, nickel, lead and chromium levels may exceed potentially applicable advisory levels, such as the EPA advisory level for ambient water quality criterion (AWQC), designated for the protection of human health from the toxic properties of a constituent ingested through water or contaminated aquatic organisms. It is noted that the referenced standard is an advisory level and may not be an enforceable

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standard.

11.0 HEALTH AND ECOLOGICAL RISK

At most contaminated waste sites, a final decision regarding the appropriate remedial action, including the "No Action" alternative, is guided in part by an evaluation of health and ecological risk. The risk assessment process is complex and is generally accomplished using an adequate data base and statistically defensible uncertainty analysis. The data paucity of the subject site would not allow for a detailed risk evaluation. A risk assessment was nonetheless performed for the site assuming that available concentration data represented maximum, "worst case" conditions for the site. The detailed assessment is provided in Attachment E.

11.1 Summary Of Health-Ecological Risk

The preliminary risk assessment provided in Attachment E suggests that there may be some adverse effects to marine and human life as a result of exposure to some toxic substances from the Armstrong/Hayes area. However, it should be emphasized that for a health risk to occur, a route of exposure (inhalation, dermal adsorption, ingestion) must be present. The contaminants of greatest concern appear to be lead and chromium. However, the available data are much too sparse to provide a true quantitative risk assessment. The preliminary risk assessment is not statistically defensible, and certain assumptions made in the assessment of risk may be subject to critique. Further, pertinent information necessary for the health risk evaluation, such as valence states of elements and the sensitivity of the chemical analytical method employed, do not allow for strict quantification.

12.0 SUMMARY

The property is underlain by artificial fill, younger bay mud, and bay side sand to the depth explored by geotechnical investigations. The artificial fill and younger bay mud are generally considered to be potentially subject to structural instability, and extensive engineering design is generally recommended for structures constructed in such material.

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Groundwater is located at less than three to five feet beneath the subject property. Tidal fluctuations may affect the groundwater flow direction and gradient. In addition, an upward (vertical) hydraulic gradient may be present in the general vicinity of the subject property.

A substantial portion of the subject property appears to have been located bayward of the line of mean high tide prior to 1942. A potential minor discrepancy may exist between the delineation of the mean high tide line as surveyed by Allardt (1868) and the shoreline as delineated in historic aerial photographs. A document addressing legal problems associated with jurisdiction of tidelands and marshes is provided as an attachment to this report.

The U.S. Navy condemned and took possession of lands adjacent to the subject property for the purpose of constructing a railroad to the Hunters Point Naval Shipyard in 1942. Initial review of court documents suggests that public access bayward of the U.S. Navy railroad right of way was restricted during the 1940s. Review of aerial photography for the period 1939 - 1957 indicates that that portion of the subject property known to be underlain by contamination emerged from the bay prior to 1948. Aerial photographs from 1946 and 1948 appear to indicate that the contaminated area was characterized by a shallow depression, which appears to have been filled with debris and may have contained ponded liquid. Access to the site appears to have been restricted to the railroad access road prior to 1948. In 1948 and subsequent years, access to the site may have been possible via one or more access points. By the time interval 1951-1953, the area of contamination was subject to final fill and grading operations. Based on review of aerial photography, the areal extent of contamination may be greater than currently defined. In addition, additional sources of contamination may be present in close proximity to the subject property, including an area approximately located within the confines of property owned by the State of California.

Excavation activities associated with the YFOC project exposed considerable construction debris, scrap iron, military hardware, naval rigging and hospital waste, as well as buried drums, waste oil, and liquid chemical waste. A newspaper clipping obtained from the excavation area places an approximate time stamp of 1945

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on fill activities in the area of contamination. A qualitative association can be surmised between waste discovered in the YFOC project area and similar areas currently subject to environmental cleanup at Hunters Point.

Subsurface investigations and chemical analyses of soil and groundwater performed by ERM-West for the City and County of San Francisco indicate that 1) a large area of floating product is located under a portion of the subject property and 2) potentially elevated concentrations of metals, degradation products of chlorinated aliphatic hydrocarbons (notably 1,1- and 1,2-dichloroethylene), polycyclic aromatic hydrocarbons (PAHs), "waste oil", and benzene may be present beneath the property. Other laboratory analyses indicate concentrations of polychlorinated biphenyls (PCBs) may also be present beneath the subject property.

Photographic evidence suggests that construction activities associated with the YFOC Project contributed to the release of contaminants into the subsurface adjacent to the subject property. In addition, the porous backfill of the sewer and outfall basin may provide for accelerated advective transport and hydrodynamic dispersion of contamination around the perimeter of the subject property, and may provide for an exposure pathway to aquatic life in South Basin, if any.

The data paucity does not allow for a detailed discussion of appropriate regulatory criteria and guidelines. Discussions provided herein do, however, delineate appropriate sections of Title 22, California Code of Regulations (CCR), and the Porter-Cologne Water Quality Control Act.

A preliminary assessment of risk is provided in Attachment E. The assessment indicates that a low probability of risk to the environment or human health may exist, provided that no significant exposure pathway is present. The risk assessment is subject to considerable uncertainty due to the paucity of available and reproducible data.

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DISCLAIMER

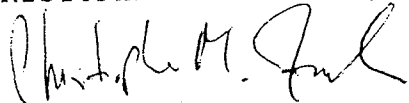
This assessment has been prepared in accordance with the accepted standards for environmental investigation at the time this investigation was performed. It should be emphasized that the statements herein are made with no specific knowledge of subsurface conditions aside from those described above. More extensive investigations, including a subsurface investigation and chemical testing, could reduce some of the inherent uncertainties associates with this type of investigation.

This report has been prepared for your exclusive use for this particular project. The opinions provided herein may not be relied upon by any other party unless otherwise expressly authorized in writing by Christopher M. French, R.G. No other warranties, expressed or implied, as to the professional advise provided, are made.

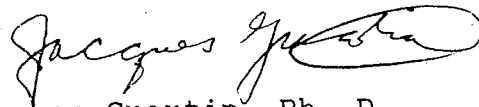
Should you have any questions, please call.

Very truly yours,

CHRISTOPHER M. FRENCH, R.G., R.E.A.



Christopher M. French, R.G., R.E.A.
Registered Environmental Assessor #307 (Exp. 6/30/90)



Jacques Guertin, Ph. D.
Associate Environmental Scientist

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Attachments

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DISCLAIMER

This assessment has been prepared in accordance with the accepted standards for environmental investigation at the time this investigation was performed. It should be emphasized that the statements herein are made with no specific knowledge of subsurface conditions aside from those described above. More extensive investigations, including a subsurface investigation and chemical testing, could reduce some of the inherent uncertainties associates with this type of investigation.

This report has been prepared for your exclusive use for this particular project. The opinions provided herein may not be relied upon by any other party unless otherwise expressly authorized in writing by Christopher M. French, R.G. No other warranties, expressed or implied, as to the professional advise provided, are made.

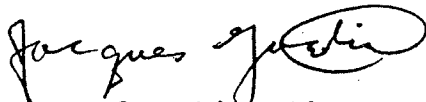
Should you have any questions, please call.

Very truly yours,

CHRISTOPHER M. FRENCH, R.G., R.E.A.



Christopher M. French, R.G., R.E.A.
Registered Environmental Assessor #307 (Exp. 6/30/90)

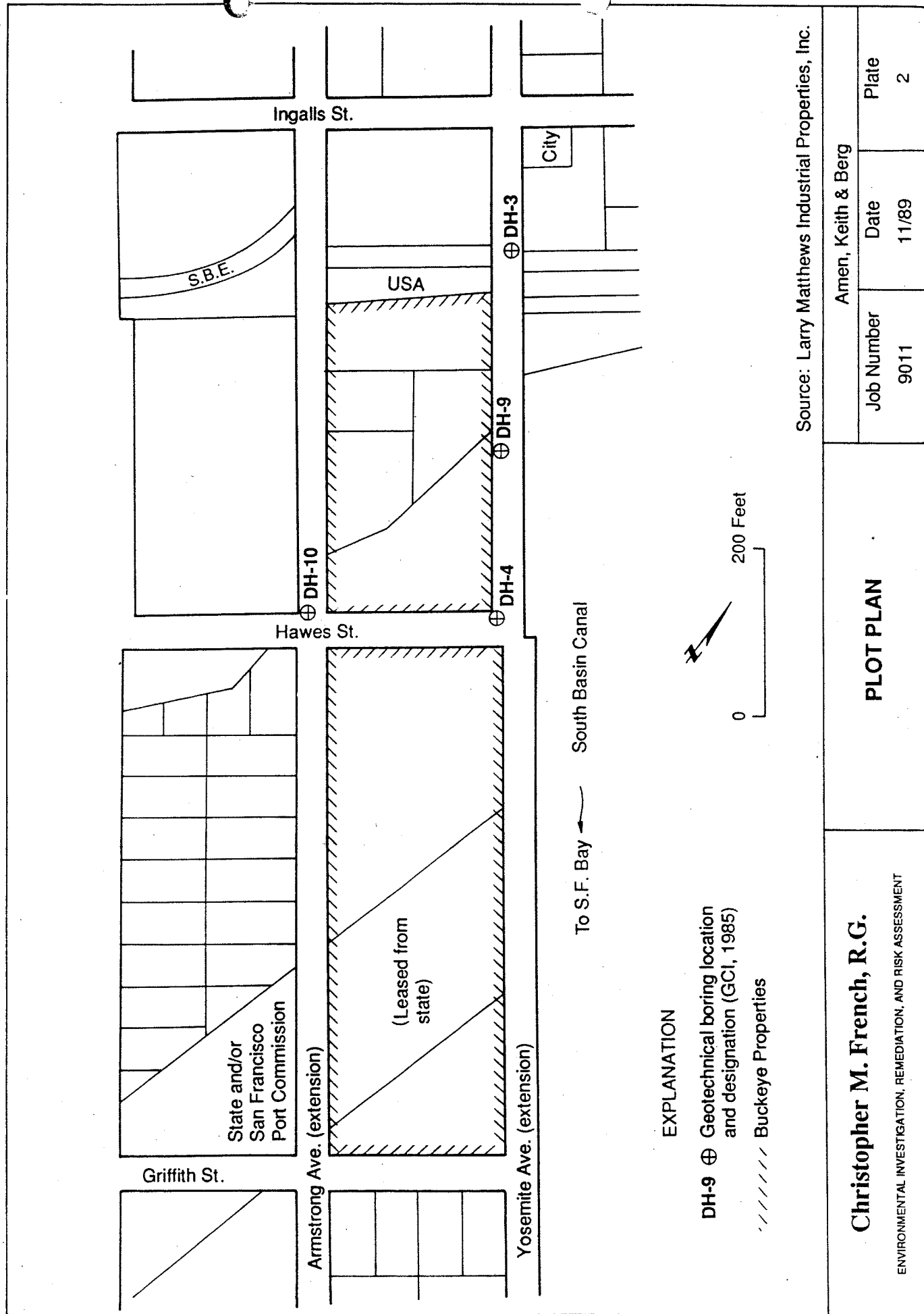


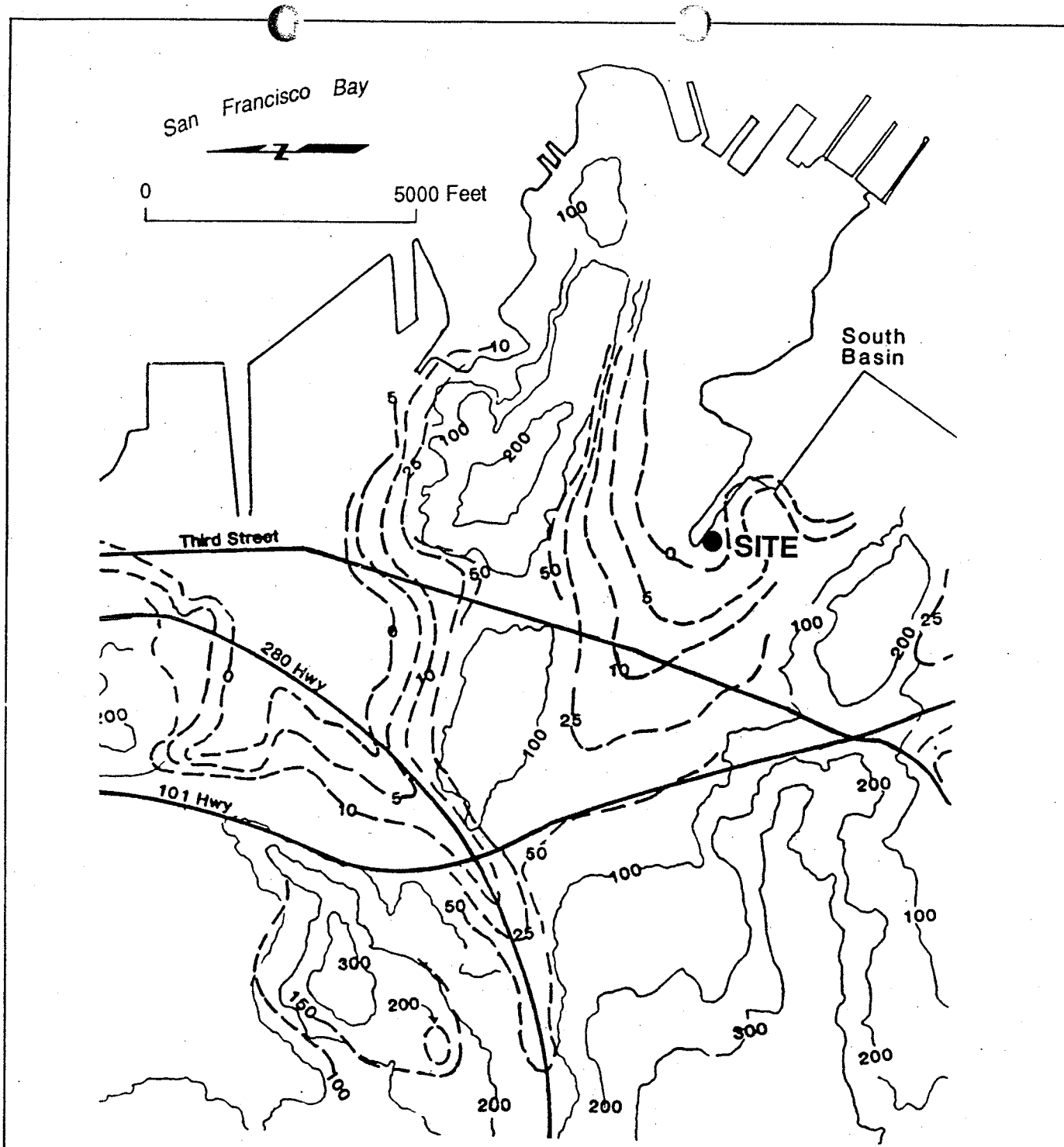
Jacques Guertin, Ph. D.
Associate Environmental Scientist

89-9001SA.I/CMF-JG/kn

Attachments

Attachment A
Plates





EXPLANATION

- 10 — Groundwater contour with elevation
in feet (S.F. City datum)
City and County of San Francisco, 1989.

Reference: San Francisco County Hazardous Waste
Management Plan. Draft EIR. 87.813E
SCN#88050318

GROUNDWATER CONTOUR MAP

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ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Amen, Keith & Berg

Job Number

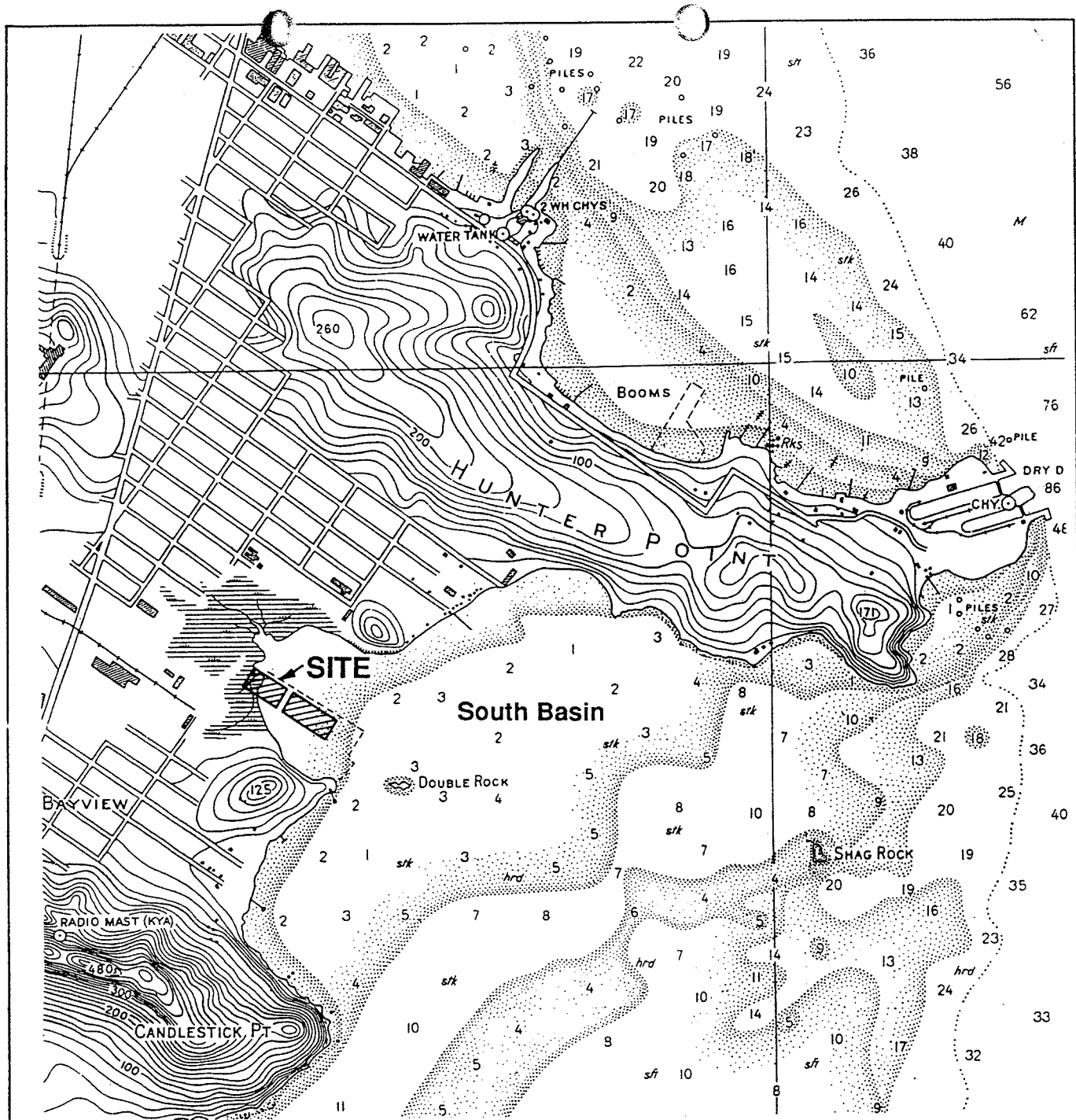
9011

Date

11/89

Plate

3



Reference: U.S. Coast and Geodetic Survey.
Washington, D.C.
January, 1942 (U.C. Bancroft Library)

COAST AND GEODETIC SURVEY MAP (1942)

Christopher M. French, R.G.

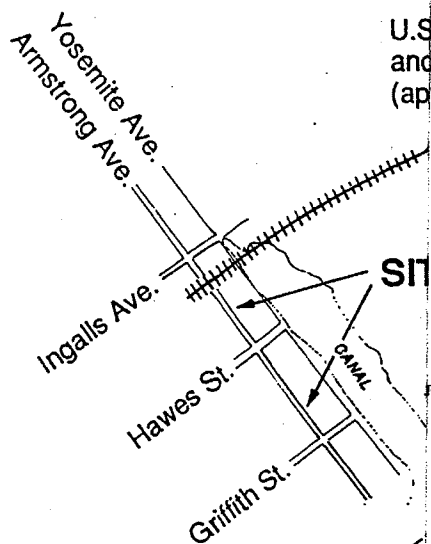
ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Amen, Keith & Berg

Job Number
9011

Date
11/89

Plate
4



U.S.
and
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PLANATION

Area Study A

Area Study B

PCB Study Area

Approximate Limits of Triple A Sites


Approximate Limits of Remedial
Investigation Sites

Existing Buildings

Boundary of Hunters Point Naval Shipyard

Approximate Limit of Bay Sediments

Confirmation Study Verification Step, Hunters Point
San Francisco, California, March 19, 1987,
Volumes

 Harding Lawson Associates Engineers, Geologists & Geophysicists		DRA
DRAWN MOI	DATE 02/17/89	
MOI	DATE 02/17/89	
MOI		

Source: Harding Lawson
Scoping Document
(San Francisco)

SOURCE MAP HUNTERS POINT

Amen, Keith & Berg

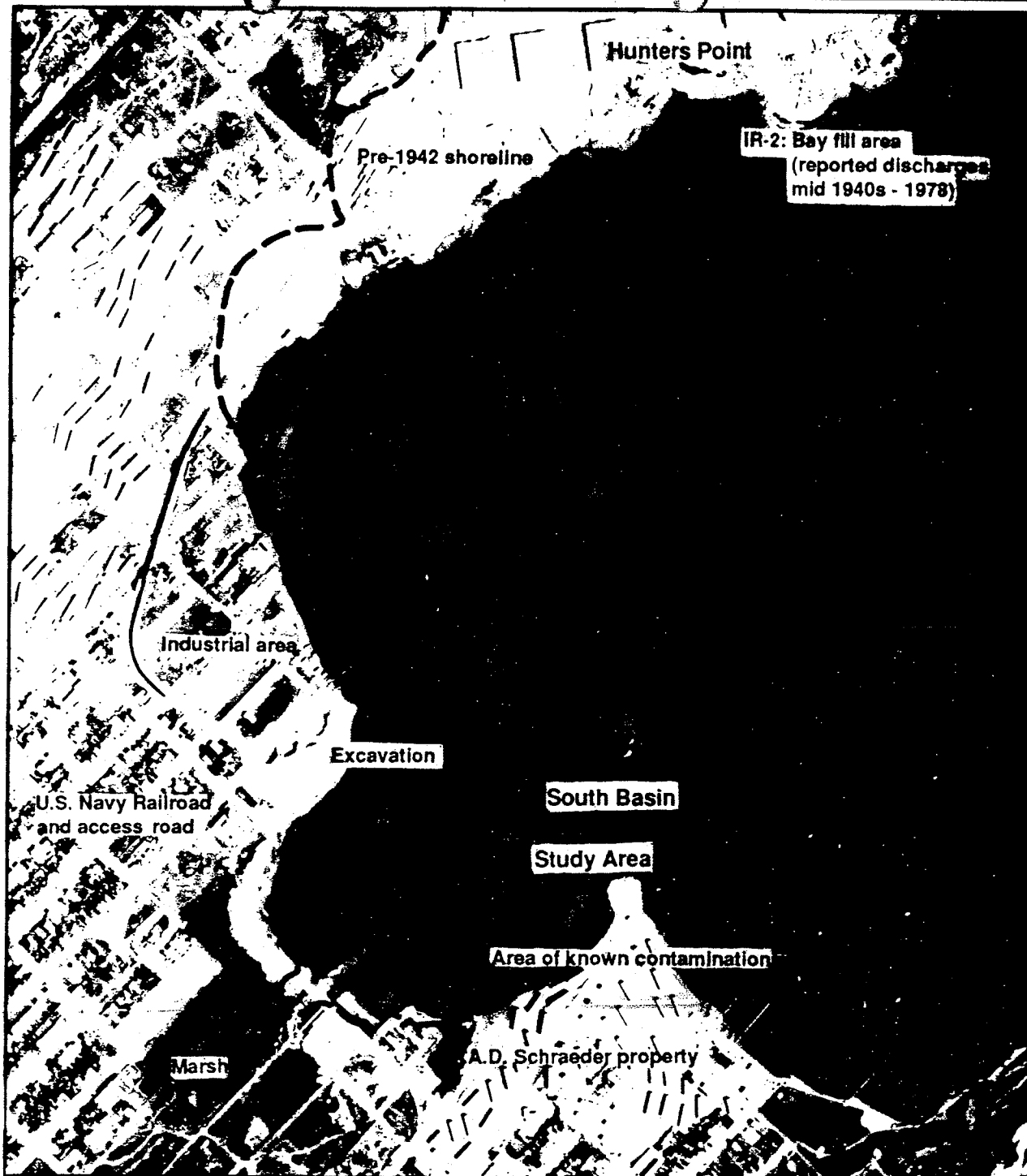
Job Number
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Date
11/89

Plate
5

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ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT



0 1000 Feet
(Approximate)

Photo base: National Archives,
Photograph DDB-2B-124,
10/11/43
Reference: Hunters Point Community Relations Program

**AERIAL PHOTOGRAPH
South Basin - Hunters Point
(1943)**

Christopher M. French, R.G.

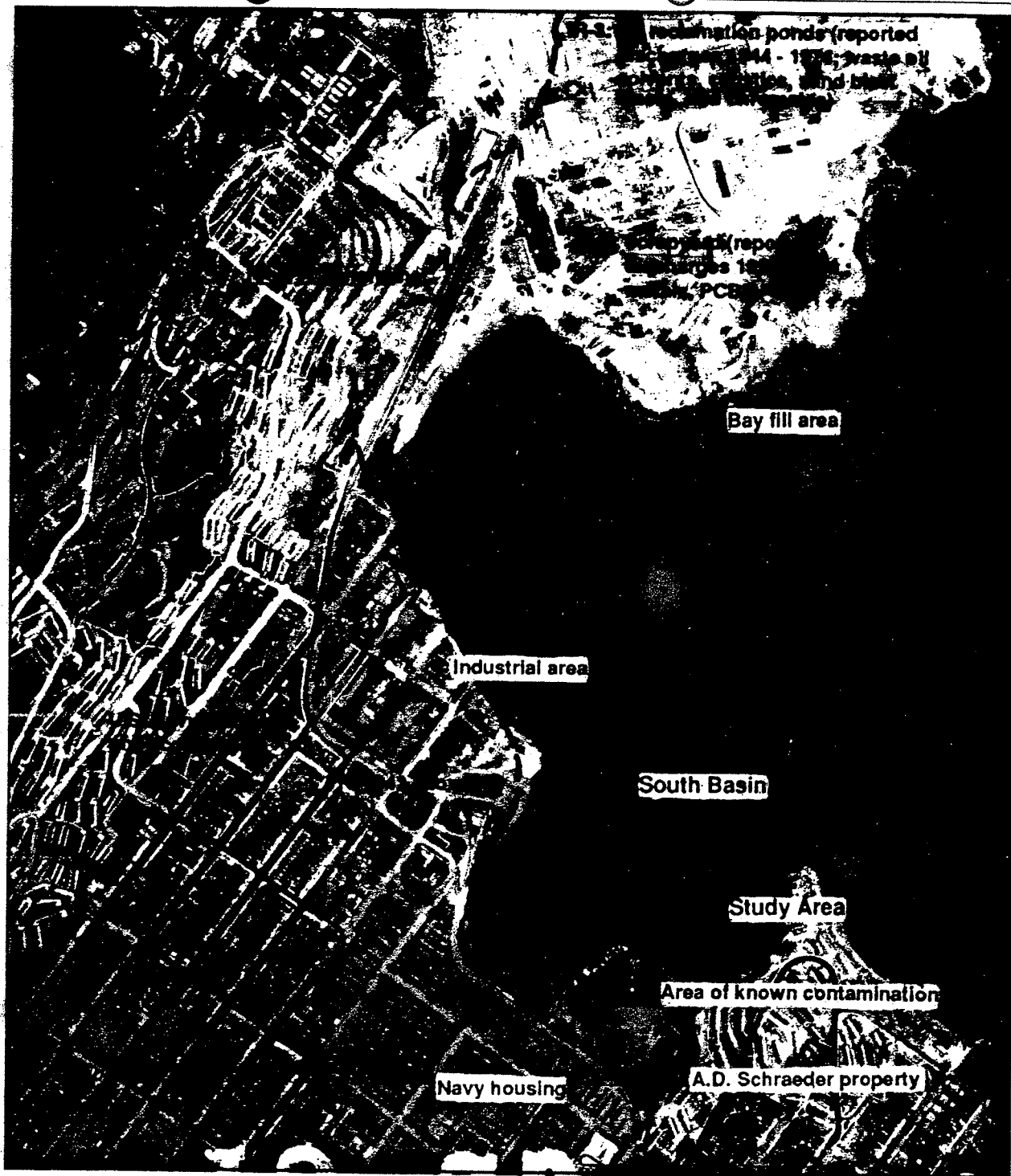
ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Amen, Keith & Berg

Job Number
9011

Date
11/89

Plate
6



0 1000 Feet
(Approximate)

Photo base: National Archives,
Photograph 2-87 GS-CP
7/29/46

Reference: Hunters Point Community Relations Program

AERIAL PHOTOGRAPH South Basin - Hunters Point (1946)

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ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Job Number

9011

Date

11/89

Plate

7



0 1000 Feet
(Approximate)

Photo base: Pacific Aerial Surveys
Photograph AV-17-12-12
7/28/48

AERIAL PHOTOGRAPH South Basin - Hunters Point (1948)

Christopher M. French, R.G.

ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Amen, Keith & Berg

Job Number
9011

Date
11/89

Plate
8



0 1000 Feet
(Approximate)

Photo base: National Archives,
Photograph 4VV5RTM 212B 5SRG
1/30/51

AERIAL PHOTOGRAPH
South Basin - Hunters Point
(1951)

Christopher M. French, R.G.

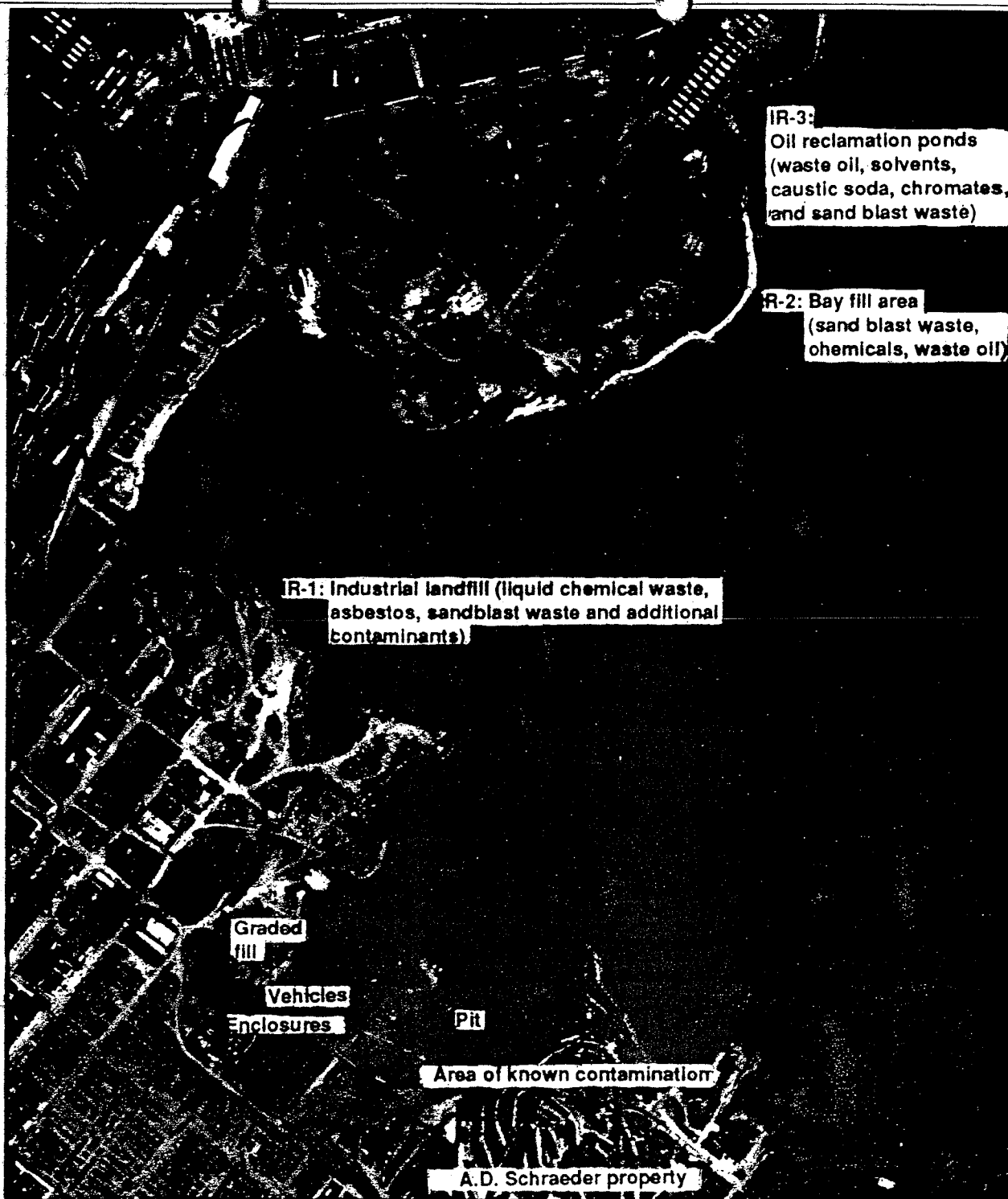
ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Amen, Keith & Berg

Job Number
9011

Date
11/89

Plate
9



0 1000 Feet
(Approximate)

Photo base: National Archives.
 Photograph VV302 TRS M 553 TAC, 10/2/53
 302/60 S-24
 Reference: Hunters Point Community Relations Program

AERIAL PHOTOGRAPH **South Basin - Hunters Point** **(1953)**

Amen, Keith & Berg

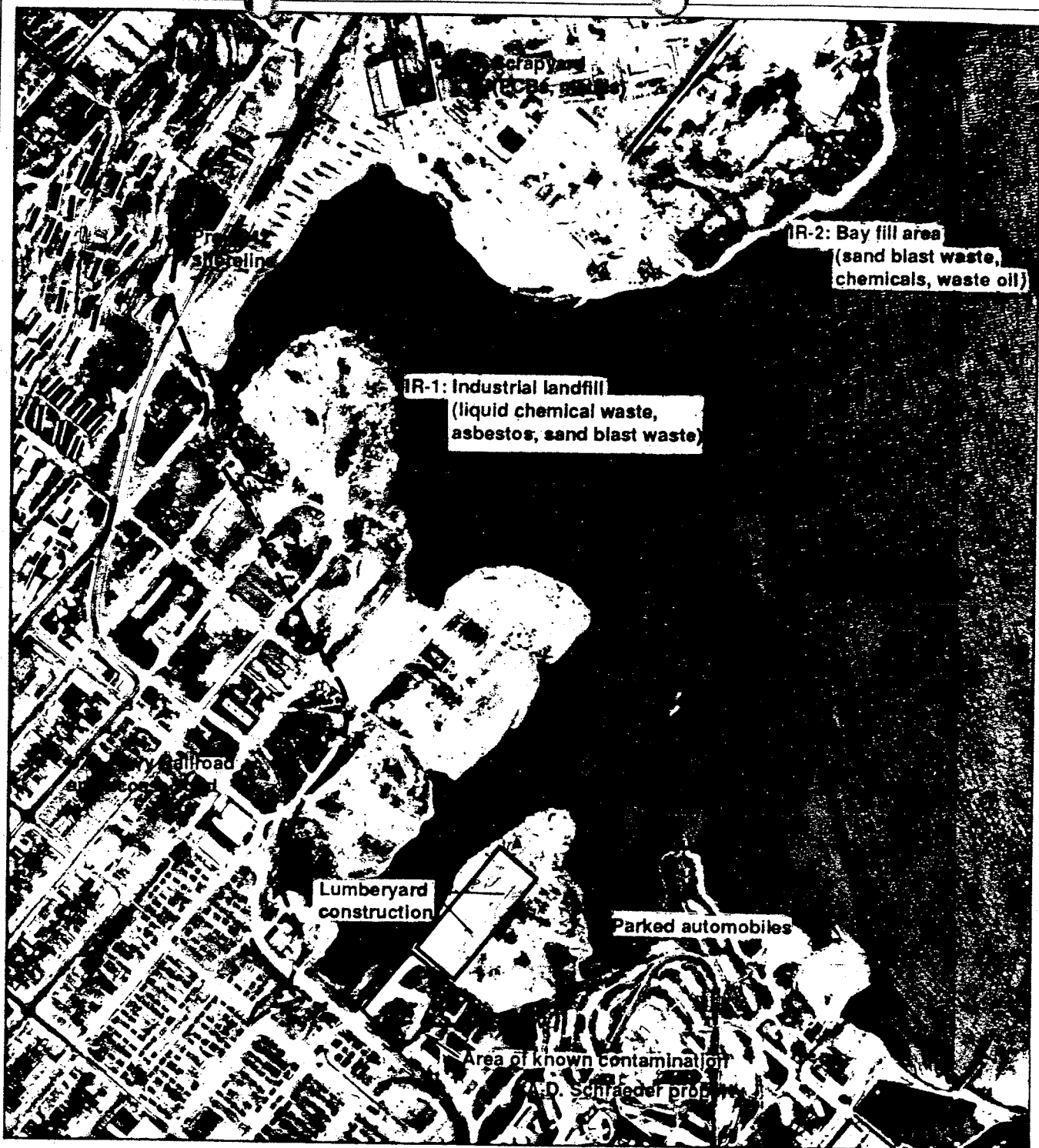
Christopher M. French, R.G.

ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Job Number
9011

Date
11/89

Plate
10



0 1000 Feet
(Approximate)

Photo base: Pacific Aerial Surveys
Photograph AV-170 08 14
5/5/55
Reference: Hunters Point Community Relations Program

AERIAL PHOTOGRAPH South Basin - Hunters Point (1955)

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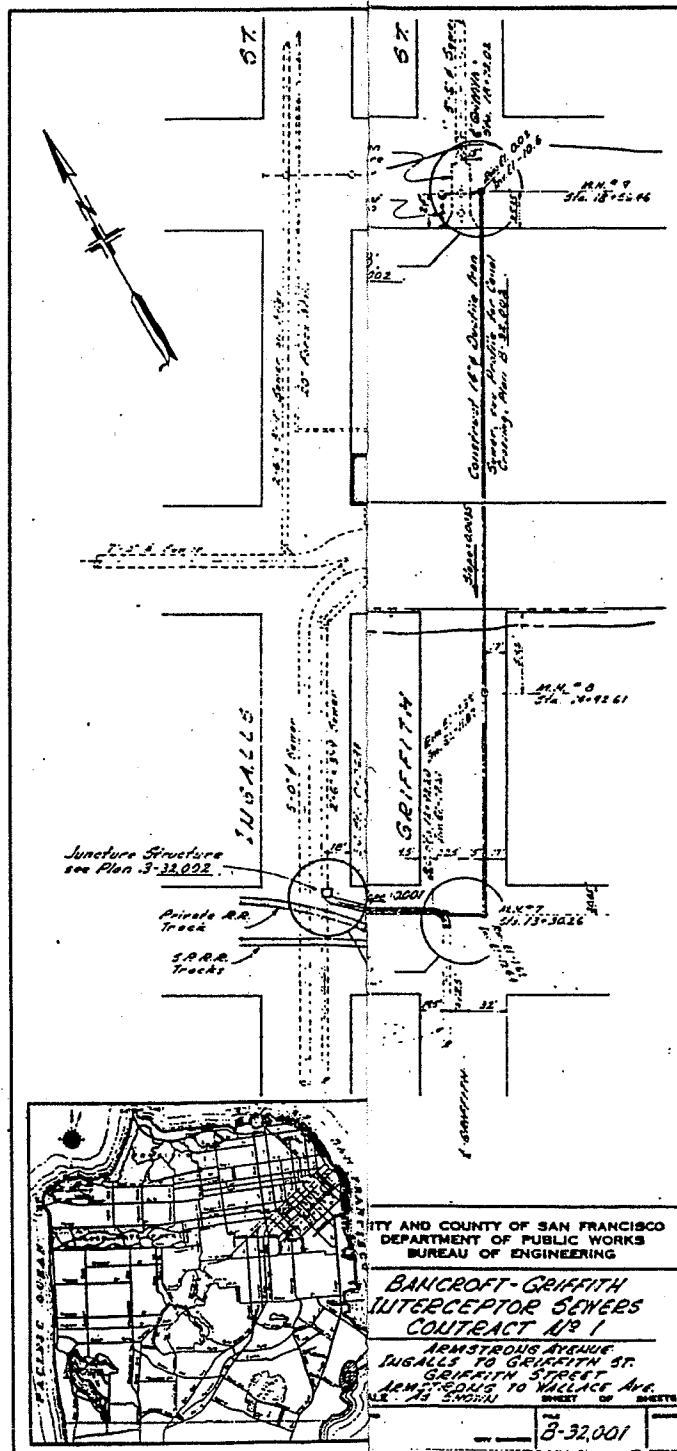
ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

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Job Number
9011

Date
11/89

Plate
11



SEWER CONSTRUCTION PLAN (1966)

Amen, Keith & Berg

Job Number
9011

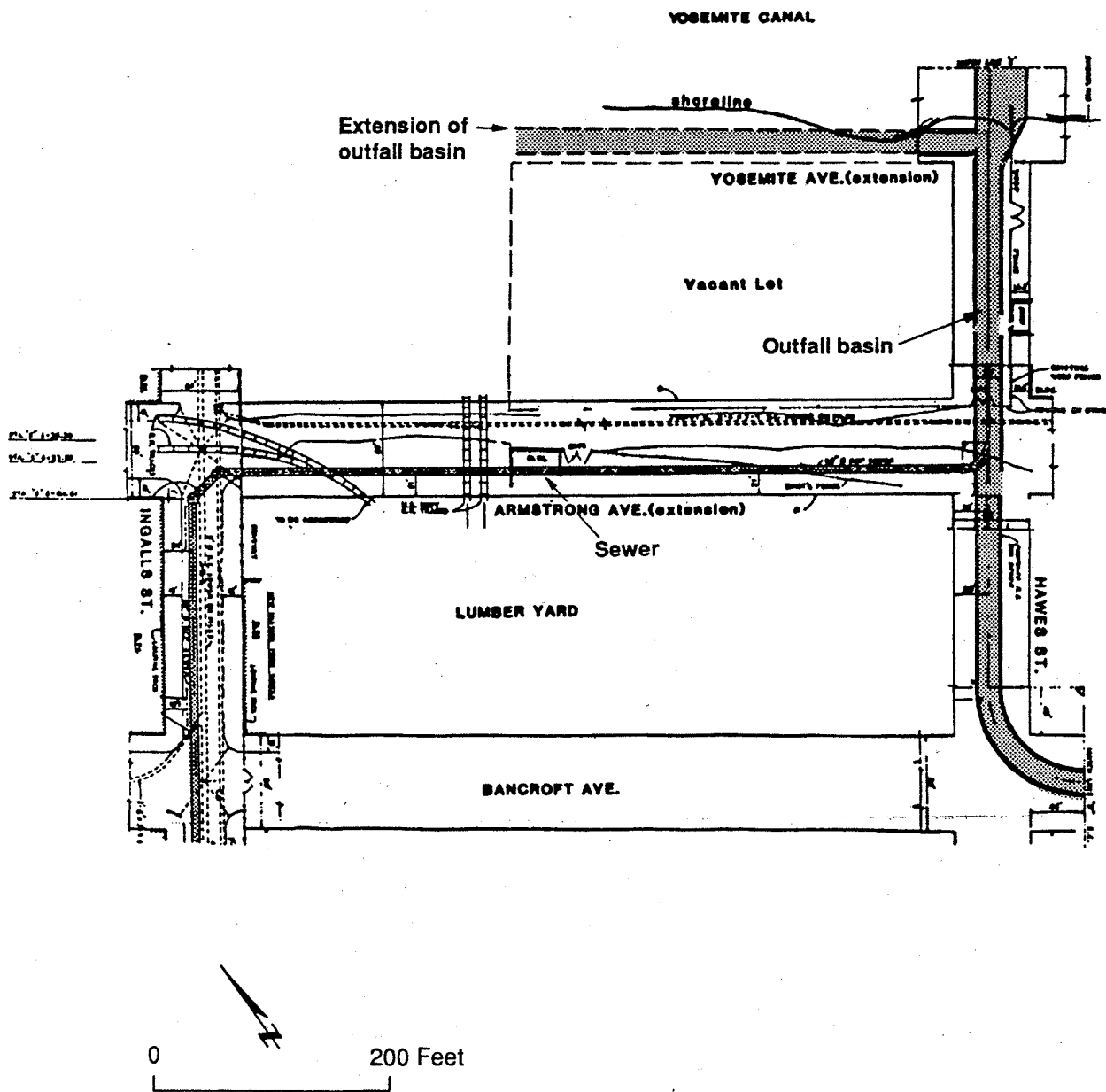
Date
11/89

Plate
12

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ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Source: City and County of San Francisco
Department of Public Works



Reference: ERM-West, 1987

SEWER CONSTRUCTION PLAN (1986 - 1987)

Christopher M. French, R.G.

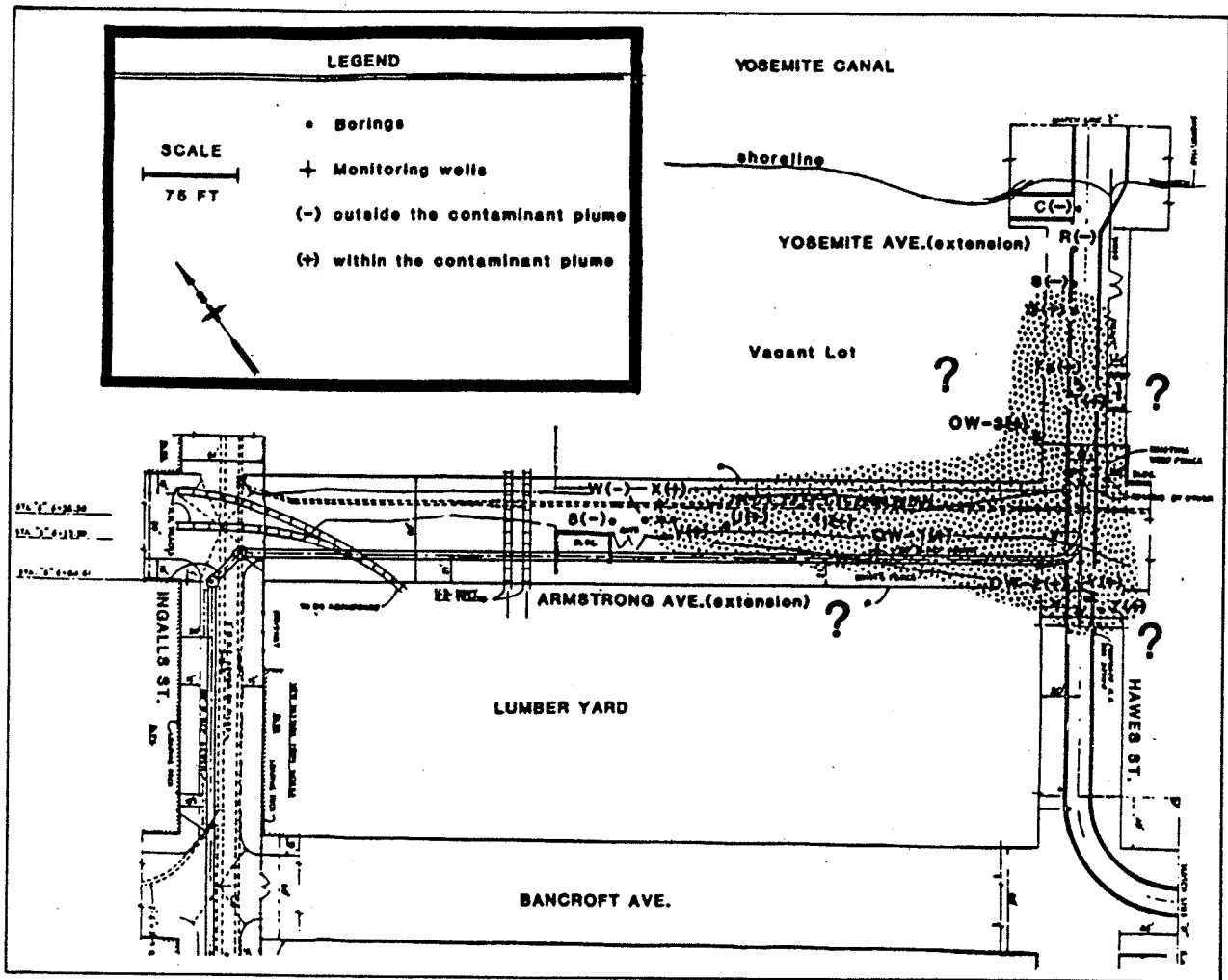
ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Amen, Keith & Berg

Job Number
9011

Date
11/89

Plate
13



0 200 Feet

Reference: "Estimated extent of subsurface
contaminant plume,
Armstrong and Hawes"
ERM-West, 1987

ERM-WEST CONTAMINANT DISTRIBUTION MAP

Amen, Keith & Berg

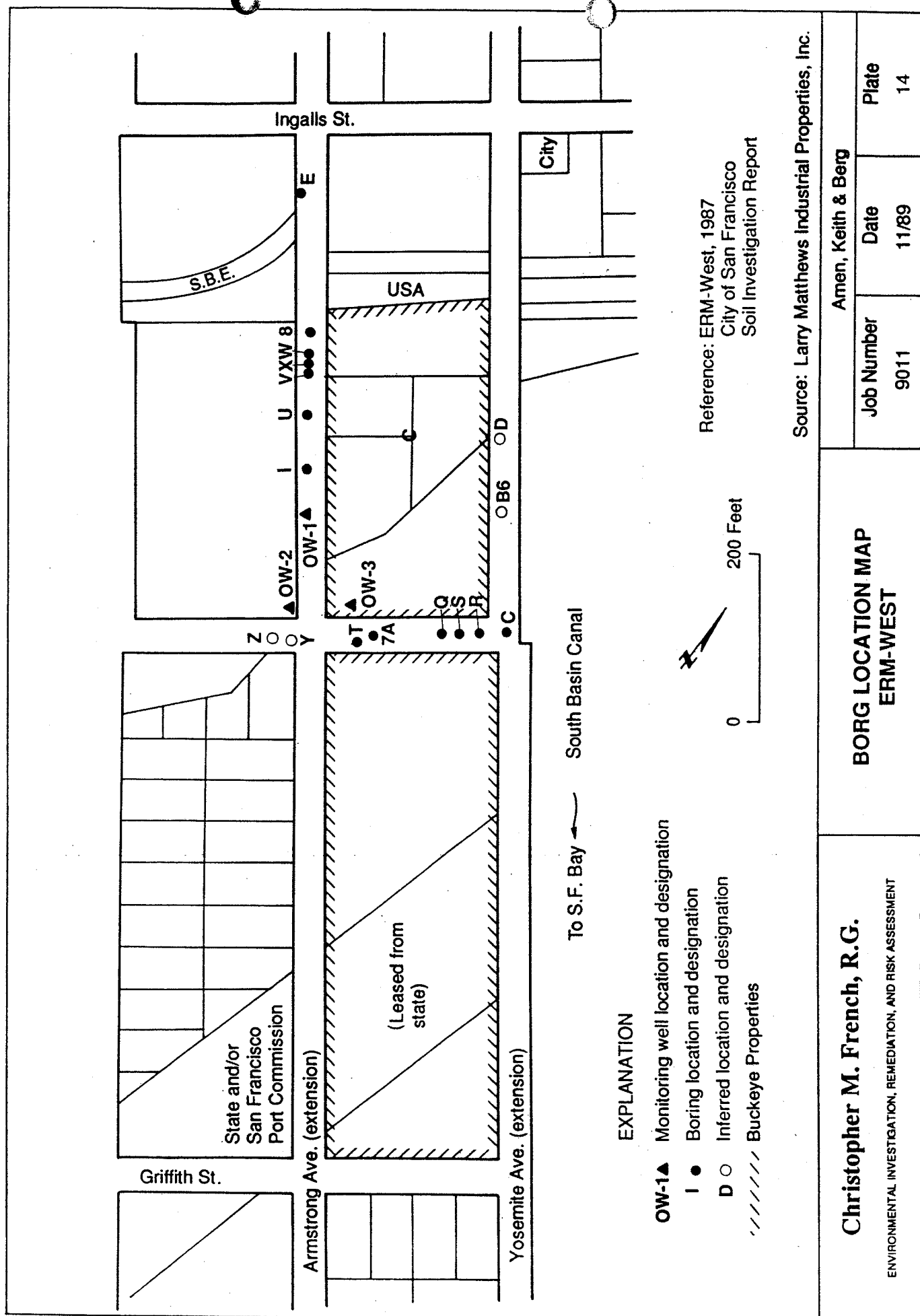
Christopher M. French, R.G.

ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

Job Number
9011

Date
11/89

Plate
15



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ENVIRONMENTAL INVESTIGATION, REMEDIATION, AND RISK ASSESSMENT

**BORG LOCATION MAP
ERM-WEST**

Job Number
9011

Date
11/89

Plate
14

Amen, Keith & Berg

Attachment B
Tables

Table 1. Aerial Photography Compilation, 1939 - 1957,
Amen, Keith & Berg, San Francisco, California

<u>Date</u>	<u>Photograph Number</u>	<u>Source</u>
1939 (?)	AV-248-07-04	Pacific Aerial Surveys
1944 (?)	unknown	Alameda NAS
10/11/43	DDB-2B-124	National Archives
03/30/45	photomosaic - none	U.C. Berkeley, Bancroft
07/25/46	2-87 GS-CP	National Archives
1940s (?)	Neg. #11318/oblique	G. Moulin Studios
May, 1947	Neg. #11520/oblique	G. Moulin Studios
May, 1947	Neg. #11525/oblique	G. Moulin Studios
07/28/48	AV-17-12-15, -16	Pacific Aerial Surveys
01/30/51	4 VV 5RTM 2128 5SRG	National Archives
05/28/52	44 VV17PL R 52-13	
	363TRG	National Archives
02/10/53	VV 302TRS M 553 TAC	
	10FEB53 302/60 S-24	National Archives
05/05/55	AV 170 08 14	Pacific Aerial Surveys
09-12-57	Negative 12117-2	G. Moulin Studios

Table 2. Groundwater Analytical Results for Boring 7A, ERM-West (1987), Yosemite Fitch Outfall Consolidation Project, Amen, Keith & Berg, San Francisco, California

<u>Constituent</u>	<u>Concentration (ug/l)</u>
<u>Base-Neutral Compounds</u> <u>(EPA Method 625)</u>	
Acenaphthylene	190
Anthracene	1,600
Benzo (a) Pyrene	66
Bis (2-ethylhexyl) phthalate	96
Chrysene	360
Fluoranthene	1,300
Fluorene	380
Naphthalene	2,700
Phenanthrene	820
Pyrene	1,000
<u>Halogenated Hydrocarbons</u> <u>(EPA Method 601)</u>	
1,1-dichloroethylene	<0.5 - 200
1,2-dichloroethylene	170
<u>Aromatic Hydrocarbons</u> <u>(EPA Method 602)</u>	
Benzene	800
Toluene	140
Ethylbenzene	1,000
Xylene	1,200

Table 3. Soil and Waste Oil Analytical Results for Borings 7A and 8, ERM-West (1987), Yosemite Fitch Outfall Consolidation Project, Amen, Keith & Berg, San Francisco, California

<u>Soil Organic Constituent</u>	<u>Boring 7A</u>	<u>Boring 8</u>
Total Pet. Hydrocarbons	680	<0.5- 7
Benzene	NR(?)	0.33-0.66
Toluene	NR(?)	<0.5-870
Ethylbenzene	NR(?)	<0.5-140
Xylene	NR(?)	<0.5- 97
<u>Waste Oil Constituent</u>	<u>Boring 7A</u>	<u>Boring 8</u>
Creosote	<10	<10
Pentachlorophenol	<10	<10
<u>Inorganic Constituents</u>		
Beryllium	<0.2	0.3
Cadmium	12	0.2
Chromium (Total?)	43	35
Copper	440	64
Lead	230	13
Nickel	140	28
Silver	0.80	0.40
Zinc	7,400	35
Antimony	1.4	<0.2
Arsenic	24	5
Selenium	<0.1	<0.1
Thallium	<0.2	0.03
Mercury	0.023	0.039
Cyanide	<0.2	<0.2

Note: Analytical data expressed in milligrams per kilogram (mg/kg), or parts per million (ppm)

Attachment C
Briscoe (1979) and
Legal Statutes

LEGAL PROBLEMS OF TIDAL MARSHES

JOHN BRISCOE

Deputy Attorney General, Room 6000 State Office Building, San Francisco, CA 94102*

Three legal problems that afflict tidal marshes are (1) the rights and liabilities of persons seeking to alter the natural condition of a marsh, (2) boundaries of ownership interests within a marsh, and (3) boundaries of the jurisdictions of government agencies having power to regulate filling, dredging or other activities within the marsh. 1) The legal theories of public nuisance and public trust are means of preventing or remedying demonstrable injury to a tidal marsh. Several cases demonstrate the law's need in this context for an understanding of the processes of the tidal marsh. 2) To determine ownership interests within a tidal marsh it is often critical to locate the line of mean high water (MHW) in either its present or some prior position. 3) Similarly, the geographical extent of the authority of government bureaus to control filling, dredging, or other human activities within tidal marshes is often a function of tidal datums. For this purpose the lines of MHW and of mean higher water (MHHW) (in either the present or some past location of the line) are most frequently employed.

Tidal marshes have bred legal problems as abundantly as their brackish reaches can breed mosquitoes in summer. While an in-depth treatment of these problems would require volumes, the purpose of this chapter is to give the scientist a brief glimpse of the law's need for his knowledge of marshes.

Two of the three subjects discussed are boundaries: boundaries of ownership interests in tidal marshes, and jurisdictional boundaries of agencies that regulate the diking, filling, dredging or other altering of marshes. The third subject, which is treated first, is the vast area of legal questions that arise from direct human threats to the viability of a marsh or to its dependent life systems.

THE DEGRADING OR DESTROYING OF MARSHES BY MAN

Human threats to marshes center on the draining or filling of marshes, or the polluting of the waters of a marsh. The legal problems chiefly entail questions of the adequacy of environmental documents prepared for a proposed project, and whether alleged threats to a marsh are real or imagined.¹ Although even a superficial survey of these questions is beyond the scope of this chapter, it shows that even before the gauntlet of modern laws was thrown down to these threats (Table 1), the law often saw a remedy for demonstrable injury to the environment. An ancient doctrine of "public nuisance," for one, afforded such a remedy. Three early California cases illustrate this doctrine.

In one landmark decision the State sought to prohibit the dumping of hydraulic-mining

*The views expressed herein are not necessarily those of the Attorney General or of other bureaus of the State.

¹ Applications for projects requiring federal, state or local approval now must usually be accompanied by assessments of the projects' environmental impacts. See National Environmental Policy Act of 1969, 42 U.S.C. §§ 4331-4347 and *Zabel vs. Tabb*, 430 F.2d 199 (1970), discussed below, and the California Environmental Quality Act, California Pub. Resources Code §§ 21000-21176, and *Friends of Mammoth vs. Board of Sup'rs of Mono County*, 8 Cal.3d 247 (1972).

SAN FRANCISCO BAY

TABLE 1. MAJOR LEGAL DEVELOPMENTS IN THE
ENVIRONMENTAL HISTORY OF SAN FRANCISCO BAY

Date	Event	Impact
1851	San Francisco Beach and Water Lot Act	First State statute authorizing the sale of tidelands to private parties. (Subsequent sales statutes pertaining to S.F. Bay were enacted in 1868 and 1870, among other dates.)
1879	New State Constitution adopted, effective 1 January 1880	Separate articles prohibited (1) private landowners from denying the public right of way to navigable waters whenever required for a public purpose, and (2) the sale to private parties of any tidelands within 2 miles of an incorporated city or town.
1913	California Supreme Ct. Decision in <i>People vs. California Fish Co.</i> 166 Calif. Reports 576.	Held that (1) tidelands sold by State to private parties remain subject to a "public trust" easement, and (2) sales of lands lying "below low tide" are wholly invalid. (Authorizing statute reviewed by Court excluded from its operations lands within five miles of San Francisco.)
1965	Creation by California legislature of S.F. Bay Conservation and Development Commission.	Temporary agency to formulate comprehensive plan for Bay; given life of four years.
1968	State - Leslie Salt Co. land agreement	First Agreement with major San Francisco Bay landowners recognizing State titles to tide and submerged lands within boundaries of lands sold by State as "swamp-and-overflowed lands." Agreement reached after 20 years of negotiations.
1969	McAteer-Petris Act	San Francisco Bay Conservation and Development Commission made a permanent agency.
	"Westbay" lawsuit filed in San Mateo County	State challenged landowners' claims of clear title to 188 acres of tide and submerged lands in S.F. Bay.
1971	Calif. Supreme Ct. Decision in <i>Marks vs. Whitney</i> , 6 Cal. Reports 3d 251	Reaffirmed principles of <i>People vs. California Fish Co.</i> Held that public trust purposes include keeping tidelands in a natural condition.
1972	Corps of Engineers amends regulations to assert regulatory authority to "former" line of mean higher-high water (i.e., prior to changes such as diking.)	Expanded jurisdiction, if valid, would encompass many salt ponds and other reclaimed marshlands.
	Westbay lawsuit expanded	Private landowners place in issue title to additional 10,000 acres of tide and submerged lands presently under S.F. Bay waters. Perhaps largest, most complex land litigation in history.
1977	Westbay case settled	State's absolute title to 75% of disputed land recognized. Remaining 25% adjudicated to be held by landowner subject to the public trust.
1978	<i>Leslie Salt Co. vs. Froehke</i>	Court of Appeals for the Ninth Circuit invalidates Corps of Engineers' regulations extending jurisdiction to former line of mean higher-high water, as to Rivers and Harbors Act jurisdiction only. Regulations respecting Corps authority under the Federal Water Pollution Control Act upheld.
1979 (?)	<i>Murphy vs. City of Berkeley</i>	California Supreme Court has taken case from Court of Appeal, which held that tideland sales in Berkeley pursuant to 1879 Act did not lift the public trust. Scope of Supreme Court's decision cannot be predicted.

BRISCOE: LEGAL PROBLEMS

debris into the North Fork of the American River. With respect to non-tidal streams, California owns the beds only of such streams that are "navigable," and the State Supreme Court wrote that the North Fork was an unnavigable stream. But because the debris was carried from the point of dumping down to the confluence with the Sacramento River, where it settled and impaired the navigability of the Sacramento, the dumping was ordered enjoined. Two statements of the Court bear consideration:

To make use of the banks of a river for dumping places, from which to cast into the river annually six hundred thousand cubic yards of mining debris, consisting of boulders, sand, earth, and waste materials, to be carried by the velocity of the stream down its course and into and along a navigable river, is an encroachment upon the soil of the latter, and an unauthorized invasion of the rights of the public to its navigation; and when such acts not only impair the navigation of a river, but at the same time affect the rights of an entire community or neighborhood, or any considerable number of persons, to the free use and enjoyment of their property, they constitute, however long continued, a public nuisance

Accompanying the ownership of every species of property is a corresponding duty to use it as that it shall not abuse the rights of other recognized owners. . . .

Upon that underlying principle, neither State nor Federal legislatures could, by silent acquiescence, or by attempted legislation, take private property for a private use, nor divest the people of the State of their rights in the navigable waters of the State for the use of private business, *however extensive or long continued*. (*People vs. Gold Run D. & M. Co.*, 66 Cal. 138, 147, 151 [1884].) (Emphasis added.)

In a later case the State sought to prohibit the damming of a small salt-marsh slough tributary to the Salt and Eel Rivers. Again the State Supreme Court held that ownership of the beds of the sloughs affected by the dam was immaterial. If damming diminished the navigability of the runk stream, it was enjoinable. And "[t]he fact that these sloughs carry tide-waters, which ebb and flow, presents no different case from one where the tributaries so dammed flowed fresh water." The Court further held that even government authorization to reclaim the marshes gave their owner no right to do anything harmful to the navigability of the state's streams. "The Swamp and Overflowed Land Act does not purport to give the owner that right, even conceding such a power in the state, and the right of the public in the use of a stream, as a public highway, is paramount to any right which the owner of the land has to reclaim his land from over flow." (*People v. Russ*, 132 Cal. 102, 105 [1901]).

The dumping of a sawmill's waste into the Truckee River was the object of another early lawsuit brought by the State. Dumping was alleged to be harmful to fish that spawned in and passed through the waters of the river. The State Supreme Court held that fish are "the most important constituent of that species of property commonly designated as wild game, the general right and ownership of which is in the people of the state. . . ." That being so, the ownership of the bed of the Truckee River was immaterial, the court held, and the People were entitled to an injunction stopping the pollution (*People vs. Truckee Lumber Co.*, 166 Cal. 397, 399, 402 [1897]).

There is evidence (Teal 1962; Johnston 1956 [San Francisco Bay]; Valiela and Vince 1976; Haedrick and Hall 1976; Sims 1970) that marshes serve as breeding grounds for various species of fish and that marsh-plant detritus is a link in the food chain of certain fish species.² Additionally there is evidence (Mitchell 1869; Pillsbury 1939; Marmer 1926) that salt marshes as reservoirs of the waters of tidal floods, keep the main estuary channels scoured and

² There are too some contrary indications with respect to the role of marsh-plant detritus as a link in food chain. (Haines 1977).

SAN FRANCISCO BAY

navigable.³ These cases indicate that even before the enactment of modern environmental protection laws, there has been an adequate understanding of the tidal marsh and its processes to provide a foundation for the legal means to prevent the degradation or outright destruction of the marsh.

This proposition seems all the more valid when these cases are read together with cases that expound the "public trust" doctrine. This doctrine holds that tidelands (in general, lands subject to tidal action and lying below the elevation of mean high water [MHW] as well as non-tidal lands below navigable waters, are held by the State subject to a public trust for purposes (among others) of navigation and fisheries (*Marks vs. Whitney*, 6 Cal. 3d 251 [1971]).⁴ And significantly, while not all tidal marshes are "tidelands" within this definition, the public-trust doctrine in California burdens property abutting tidelands and navigable waters, as well as the tidelands and navigable waters themselves, "with a servitude commensurate with" the public trust power itself (*Colberg, Inc. vs. State of California ex rel. Dept. Pub. Wks.*, 67 Cal. 2d 408, 420 [1967]; *Miramar Co. vs. Santa Barbara*, 23 Cal. 2d 170 [1943]). In other words, the public-trust power, while arising from the State's ownership of "tidelands," nevertheless may extend shoreward of the tideland boundary when necessary to effect the purposes of the trust. The significance of this principle is that action taken pursuant to this power requires no payment of compensation to the landowner, since the affected property is already "burdened" with that power (i.e., the landowner bears the risk that the power may be exercised). The *Just* case, discussed below, explores the area of compensation more fully.

Three contemporary cases which have had a profound impact on this subject of man's degradation of marshes should be mentioned briefly. Describing the doctrine of nuisance as "the oldest form of land use control," the California Court of Appeal in 1974 held valid California's coastal initiative (passed by the voters in 1972 and popularly known as "Proposition 20"), in part in reliance on that doctrine (*CEED vs. California Coastal Zone Conservation Com.*, 43 Cal.App.3d 306, 318[1974]).⁵

³ "Mitchell's Rule" is: "A river having a bar at its mouth will be injured as a pathway for navigation if the tidal influx is reduced by encroachments upon its basins." Grove Karl Gilbert (1917: 102-103) described shoaling that had occurred in Mare Island Strait since the advent of marshland reclamation and hydraulic mining. "... I am not aware that the influence of reclamation has been mentioned in this connection, but there need be no question that the impairment of the channel has been caused in part by the weakening of the tidal currents," which had been in turn caused by reclamation of the adjoining marshlands.

⁴ The *Marks* case held specifically: "Public trust easements are traditionally defined in terms of navigation, commerce and fisheries. They have been held to include the right to fish, hunt, bathe, swim, to use for boating and general recreation purposes the navigable waters of the state, and to use the bottom of the navigable waters for anchoring, standing, or other purposes. The public has the same right in and to [even privately owned] tidelands.

"The public uses to which tidelands are subject are sufficiently flexible to encompass changing public needs. In administering the trust the state is not burdened with an outmoded classification favoring one mode of utilization over another. There is a growing public recognition that one of the most important public uses of the tidelands—a use encompassed within the tidelands trust—is the preservation of those lands in their natural state, so that they may serve as ecological units for scientific study, as open space, and as environments which provide food and habitat for birds and marine life, and which favorably affect the scenery and climate of the area. It is not necessary to here define precisely all the public uses which encumber tidelands." 6 Cal.3d at 259-260 (Citations omitted). As discussed in the section concerning ownership, below, it must be considered in each case whether the tract of marshland in question is in fact "tideland" within the legal definition, or falls within some other legal classification of land.

⁵ "The law of nuisance, called the oldest form of land use control, evolved from the ancient maxim 'sic utere tuo ut alienum non laedes'—one must so use his rights as not to infringe on the rights of others. At common law a public nuisance was defined as an act or omission which obstructs or causes inconvenience or damage to the public in the exercise of rights common to all 'Her Majesty's subjects.' Subject to constitutional barriers against unreasonable or arbitrary action, the Legislature may declare that a specified condition or activity constitutes a public nuisance. The power of the state to declare acts injurious to the state's natural resources to constitute a public nuisance has long been recognized in this state. Contemporary environmental legislation represents an exercise by government of this traditional power to regulate activities in the nature of nuisances. ..." (Footnotes and citations omitted). 43 Cal.App.3d at 318.

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A Federal appeals court in 1970 held that the U.S. Army Corps of Engineers, in reviewing applications to fill or dredge navigable waters, may consider environmental consequences of the proposal and is not confined to considering only the effect of the project on the Corps' traditional ward, navigation (*Zabel vs. Tabb*, 430 F.1d 199 [5th Cir. 1970]).

A 1972 Wisconsin Supreme Court decision, *Just vs. Marinette County*, has similarly been considered a landmark case in environmental law, particularly with respect to marshlands. A county ordinance, enacted pursuant to State law, prohibited the filling, draining or dredging of "wetlands" without a permit. The legal question was whether these restrictions amounted to a "constructive" (i.e. virtual) taking of property for a public use, which under the constitution would require the payment of just compensation to the owners. States have the power of eminent domain, which authorizes the taking of private property for public purposes upon the payment of just compensation, and they also have the police power, which is the basis for our criminal and health laws. When laws enacted under the police power restrict the uses to which land can be put, there is often the charge that the restrictions amount to a "taking" that requires compensation. Just when a land-use restriction becomes a "taking" is an elusive question. It has been the subject of many court decisions and journal articles, no one of which has formulated a criterion that is satisfactory in all cases. The extent of the restriction, and the loss of value it causes, are frequently examined, but are not necessarily determinative. In *Just vs. Marinette County*, the court analyzed the issue according to an old, and not always adequate, formulation: whether the restriction is intended to secure a benefit for the public it does not presently enjoy, or whether it is intended to prevent an injury to the public. Since this ordinance was designed merely to preserve the *status quo* (i.e. to prevent further degradation of water quality and wildlife habitat), it was held a valid exercise of the police power, and not a taking.⁶ Although hailed as an important natural-resources decision, *Just* nonetheless did not treat, nor did the controversy require it to treat, the question of proper remedies for past injury to wetlands.

OWNERSHIP

Ownership, the second area of legal problems affecting tidal marshes, may be as intricate as a marsh's network of sloughs and rivulets. Although some marsh lands were granted to individuals by Spain and Mexico when those countries were sovereign in California, to be recognized after the United States' annexation of California, these grants were required to be confirmed by a Board of Land Commissioners especially created to hear the claims of persons to such grants.

With the exception of this unique category of land, there are three legal classifications (or "characters") of land found within tidal marshes: "swamp-and-overflowed lands," "tidelands," and "submerged lands." (These are court-defined legal expressions having no intrinsic engineering or scientific meaning). With few exceptions, submerged lands, lands lying waterward of the "ordinary low water mark," were never made available for private purchase and purported purchases of these lands are void. [Editor's note: See Atwater et al. 1979, Table 1 for definition of tide-datums and heights.] But statutes authorizing the sale of both tidelands and swamp-and-overflowed lands

⁶ The Just Court reasoned: "We are not unmindful of the warning in *Pennsylvania Coal Co. vs. Mahon* (1922) U.S. 393, 416, 43 S.Ct. 158, 160, 67 L.Ed. 322:

'... We are in danger of forgetting that a strong desire to improve the public condition is not enough to warrant achieving the desire by a shorter cut than the constitutional way of paying for the change.' This observation refers to the improvement of the public condition, the securing of a benefit not presently enjoyed and to which the public is not entitled. The shoreland zoning ordinance preserves nature, the environment, and natural resources as they were created and to which the people have a present right. The ordinance does not create or improve the public condition but only preserves nature from the despoilage and harm resulting from the unrestricted activities of humans.' 201 N.W. 2d at 771.

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were enacted by the California legislature in 1850. And while the same laws provided for the sale to private parties of both these characters of land, the distinctions between the two types of land are critical. For as to swamp-and-overflowed lands:

"The lands which passed to the state by grant under the Swamp Land Act were thereafter subject to absolute alienation by the state, free of any public trust for navigation. (*Newcomb vs. City of Newport Beach*, *supra*, 7 Cal. 2d 393, 400.)

Whereas the purchaser of tidelands

owns the soil, subject to the easement of the public for the public uses of navigation and commerce, and to the right of the state, as administrator and controller of these public uses and the public trust therefor, to enter upon and possess the same for the preservation and advancement of the public uses, and to make such changes and improvements as may be deemed advisable for those purposes. (*People vs. California Fish Co.*, *supra* at 598).

But determining where a tract of swamp-and-overflowed land (or "swamp land" for short) ends and the tideland begins may not be a simple matter. The California Supreme Court has observed:

These swamp and overflowed lands embraced large areas in the interior of the state, situated in the San Joaquin and Sacramento valleys, and extending down to tide water in the bay of San Francisco. There the tide flats in many places merged into them imperceptibly, making it difficult to distinguish between them. (*People vs. California Fish Co.*, 166 Cal. 576, 591 [1913]).

To demonstrate why this difficulty exists it is necessary to examine the roots of title to these two characters of land (Fig. 1). Tidelands and other lands beneath navigable waters within California became the property of the State as an incident of sovereignty when California became a state on 9 September 1850.⁷ (These lands were held by the State in the public trust mentioned above). Excepting the grants made previously by the Spanish and Mexican governments, all other land within the State was then the property of the Federal government, including "swamp-and-overflowed lands," which Congress granted to California 19 days later.⁸ With certain possible exceptions, the boundary between the tideland and the upland (swamp lands being a species of upland) is a line the law calls the "ordinary high water mark."⁹

But like "tidelands" and "ordinary low water mark," "ordinary high water mark" is a legal expression that has no intrinsic meaning to an engineer or surveyor. Courts have given it meaning as to certain types of topography. It has been held for example that the ordinary high water mark along a non-tidal navigable river is the line at which vegetation stops (see *Oklahoma vs. Texas*, 260 U.S. 606, 632 [1922]; Skelton, *Boundaries and Adjacent Properties* 310-11 [1938]).

After much confused law on the meaning of the term for purposes of tidal water boundaries,

⁷ *Martin vs. Waddell* 41 U.S. (16 Pet.) 367, 410 (1842); *Shively vs. Bowlby*, 152 U.S. 1, 15, 26 (1894); *Weber vs. Harbor Commissioners*, 85 U.S. (18 Wall) 57, 65-66 (1873); *People vs. California Fish Co.*, 166 Cal. 576, 584 (1913); *Marks vs. Whitney*, 6 Cal.3d 251, 258 (1971).

⁸ 9 Stats. 519 (28 September 1850), 43 U.S.C. § 981 et seq.

⁹ *Barney vs. Keokuk*, 94 U.S. 324, 336-38 (1876); *Borax, Ltd. vs. Los Angeles*, 296 U.S. 10, 22 (1935); *Wright vs. Seymour*, 69 Cal. 122, 126 (1886); *Long Beach Co. vs. Richardson*, 70 Cal. 206 (1886); *Oakland vs. Oakland Water Front Co.*, 118 Cal. 160, 183 (1897); *Pacific Whaling Co. vs. Packers' Association*, 138 Cal. 632, 635, 636 (1903); *People vs. California Fish Co.*, *supra*, 166 Cal. 576, 584 (1913); Civil Code § 670. See also *Strand Improvement Co. vs. Long Beach*, 173 Cal. 765, 770 (1916); *Miller & Lux vs. Secara*, 193 Cal. 755, 671, 762 (1924).

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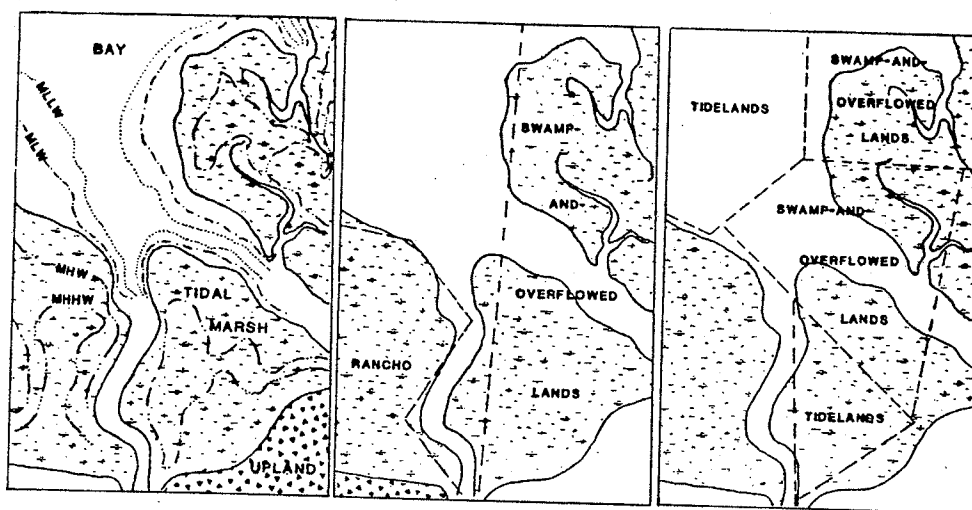


Fig. 1. Projection of tidal datums (left) and property lines (center and right) onto a hypothetical tidal marsh. Center diagram shows lines surveyed by the U. S. Government after the annexation of California in 1848. The ranch was granted to a private party by either Spain or Mexico before annexation, confirmed by the American Board of Land Commissioners after annexation, and subsequently surveyed by the Federal government. The government was also required to identify the "swamp-and-overflowed lands" that it granted to California on 28 September 1950, and often did so by survey. Surveyors were not always careful to locate the true "ordinary high water mark," or as it has been defined by some courts, the mean high water line. Nonetheless the true boundary remains the ordinary high water mark, no matter how erroneous the survey, which was run chiefly to compute acreages. California laws enacted in 1850 authorized the sale to private purchasers of tidelands and swamp-and-overflowed lands. These sales were made according to surveys that frequently did not correspond to the Federal surveys, much less the actual topography. The right-hand figure depicts a typical pattern of surveys done for these State sales. This lack of congruence between the true physical conditions and the designations of title documents creates many title disputes today.

the U.S. Supreme Court held in 1935 that the "ordinary high water mark" separating privately owned uplands (which had been sold by the Federal government) from the tidelands of San Pedro Harbor was the line of mean high water (*Borax Ltd. vs. Los Angeles*, 296 U. S. 10 [1935]).¹⁰ For the first time surveyors and engineers had authoritative guidance how to locate the ordinary high water mark, since the mean high water line is the intersection with the shore of the plane of a published, precisely determined tidal datum (Shalowitz 1964:581). It is not always, however, an easy task to determine precise elevations in a marsh:

Obviously, it would be an extremely difficult task to identify the actual high-water line in marsh areas. The marsh may be in various states of growth, from its early beginnings, when it is mostly a submerged stage, to its latest development, when it is close to or slightly above the plane of high water. Between these two extreme

¹⁰ See, e.g., *Teschmacher vs. Thompson*, 18 Cal. 11, 21 (1861); *Otey vs. Carmel Sanitary District*, 219 Cal. 310, 313 (1933). These cases may be read as asserting that the "ordinary-high-water-mark" is not equivalent to the line of mean high water, that is, the mean of all high waters, but rather to a line of the mean of "neap" high waters. The error of this position from a legal standpoint, and the courts' fanciful misconceptions of neap tides, have been thoroughly explored (Maloney and Ausness 1975).

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conditions, marsh areas may be entirely submerged at low water, may be exposed at low water and submerged at high water, or may be partially exposed at high water. . . (Shalowitz 1964:176-177).¹¹

Thus locating the MHW line in a natural marsh is not always a simple matter. Moreover, artificial changes in the condition of a marsh may further complicate the determination of the legal character of the land (see for example Atwater et al. 1979). For when a marsh has been filled, diked, or otherwise altered by man, the relevant legal inquiry *may* shift from the present land elevations to the elevations of the land when it was last in a natural condition.¹² When the inquiry does so shift, an expert must determine first the existence of any changes that have occurred in the marsh, such as diking, dredging or filling, or more subtle changes such as eolian deflation, subsidence, or accretion to or erosion of the marsh edge. The expert must then determine the cause of these changes. Desiccation or ground-water withdrawal may be causes of subsidence, and alteration of the natural sedimentation or wave patterns may be causes of a prograding or retrograding marsh edge. The next task is to determine (as well as possible) the conditions that existed before the change, specifically the marsh-surface elevations.

Of interest to the marsh botanist are the attempts that have been made to locate the MHW line in a natural marsh by determining the distribution of vascular plants with respect to tidal datums (Maloney and Ausness 1974). A New York court has rejected such an approach as inconsistent with that state's law of coastal boundaries.¹³

Of course, locating the ordinary high water mark is not the only task that must be done. Historical research and legal analysis of documents in the chain of title must be completed before the true state of ownership can be determined.

JURISDICTION OF REGULATORY AGENCIES

As with questions of ownership, tidal datums largely dictate the authority and responsibility of agencies having jurisdiction over the uses of tidal marshes. The U. S. Army Corps of Engineers has authority to regulate the diking, dredging or filling of marshes. The Corps has two statutory

¹¹ Further evidence of the problem of surveying a mean-high-tide line in tracts of swamp is contained in several technical documents:

(a) Field Memorandum No. 1, United States Coast and Geodetic Survey (1938): "In marsh, mangrove, and cypress or similar swamp areas, the mean high water line is generally obscured by the vegetation and will not ordinarily be located."

(b) See also U.S. Coast Survey (1865), App. 22; p. 205; 1891, App. 16; p. 609, 633-34.

(c) The U.S. Coast and Geodetic Survey (1928) instructed:

"43. The high-water line.—The high-water line shall be drawn with sufficient strength to make it clearly distinguishable. The identification of the high-water line on marsh is usually difficult. The outer edge of a typical marsh is vertical and is sometimes covered at high-water, but for use on navigational charts its vertical edge should be indicated as the high-water line. The inner edge of the marsh (the limit of submergence at high water) when clearly defined may be drawn by a line distinctly lighter than the high-water line. . . ."

(d) The U. S. Coast and Geodetic Survey (1963:42) explains: "The mean high-water line in marsh, mangrove, cypress, or similar swamp areas is generally obscured by vegetation and will not ordinarily be located on topographic surveys. In such areas, the outer edge of vegetation visible above Mean High Water, usually represented by a fine line on the topographic survey, presents a fairly definite shoreline. . . ."

¹² *Carpenter vs. City of Santa Monica*, 63 Cal.App.2d 772, 787-788 (1944); *City of Los Angeles vs. Anderson*, 206 Cal. 662, 667 (1929) Civil Code § 1014; *O'Neill vs. State Highway Dept.*, 235 A.2d 1, 10 (N.J. 1967). The federal rule appears to ignore at least some artificial changes *County of St. Clair vs. Livingston*, 90 U.S. (23 Wall.) 46, 68 (1874), but it may be rare that the Federal rule applies in California. *Or. ex rel. State Land Bd. vs. Corvallis Sand & G.*, 97 S.Ct. 482 (1977).

¹³ *Dolphin Lane Assoc. vs. Town of Southampton*, 372 N.Y.S. 2d 52, 53-54 (1977).

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bases for this authority. Sections 9 and 10 of the Rivers and Harbors Act of 1899¹⁴ essentially prohibit the building of any "dam," "dike," "obstruction," or "other structures" within the "navigable waters of the United States" without the approval of the Corps. Similarly section 404 of the Federal Water Pollution Control Act as amended in October 1972 (FWPCA)¹⁵ charges the Corps with regulating the discharge of dredged or fill material into "navigable waters."

The meanings of the term "navigable waters of the United States" and the simpler term "navigable waters," then, are critical to the jurisdiction of the Corps. Originally separate regulations defining these terms were adopted by the Corps for the Rivers and Harbors Act and for the FWPCA.¹⁶ These regulations were revised and integrated effective 19 July 1977 and codified in Title 33, Code of Federal Regulations, sections 320 *et seq.*¹⁷ There are two definitions for purposes of the Rivers and Harbors Act. If lands are used, or have been used, or may be susceptible to use to transport interstate or foreign commerce, they are "navigable waters of the United States." Secondly the term includes all lands subject to the ebb and flow of the tide shoreward on the Pacific Coast to the line of mean higher high water (MHHW).¹⁸ Significantly, "an area will remain 'navigable in law,' even though no longer covered with water, whenever a change in condition has occurred suddenly, or was caused by artificial forces intended to produce that change."¹⁹ Thus in diked or filled marshes, one must determine the "former" line of MHHW.

For purposes of the FWPCA, the regulations define "navigable waters" much more broadly than they define "navigable waters of the United States" for the Rivers and Harbors Act. The FWPCA regulation subsumes "navigable waters of the United States" since it includes both the "susceptibility" and the MHHW definitions, but it additionally includes all marshes, swamps and "similar areas," among other features.²⁰

An additional regulation giving a much more detailed definition of the term "navigable waters of the United States" is set forth in section 329.1 *et seq.* of Title 33 of the Code of Federal Regulations. This section, which gives numerous examples intended to illustrate the term, applies to jurisdiction asserted under both the Rivers and Harbors Act and the FWPCA. It also includes the interpretation that lands formerly subject to the tides but which have been excluded from tidal action by dikes or other man-made works are still "navigable waters of the United States."²¹

The complexities of determining, for example, whether the Corps has jurisdiction under the Rivers and Harbors Act over a tract of reclaimed marsh are apparent. If the marsh cannot be said to have been "susceptible of use for commercial navigation," then it must be determined whether in its natural state it lay above or below the MHHW elevation. Determining elevations within a natural marsh may pose problems enough (see also National Ocean Survey 1975). But, as discussed above, when it has been walled off from the tides many factors can further complicate determining

¹⁴ 33 U.S.C. § 401 *et seq.*

¹⁵ 33 U.S.C. § 1251 *et seq.*

¹⁶ These regulations, now superseded, were codified at 33 C.F.R. § 209.120(d) (1), together with 33 C.F.R. § 209.120(d)(1), together with 33 C.F.R. § 209.260 *et seq.* (regulations for the Rivers and Harbors Act), and 33 C.F.R. § 209.120(d)(2) (regulations for the FWPCA).

¹⁷ See 42 Fed. Reg. 37122 *et seq.* (July 19, 1977).

¹⁸ 33 C.F.R. §§ 321.2 and 322.2.

¹⁹ 33 C.F.R. § 329.13.

²⁰ 33 C.F.R. § 323.2 (b), and (c).

²¹ 33 C.F.R. § 329.13.

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former elevations of the marsh. There is evidence that when drained and allowed to dry, the marsh soil compacts so that its elevation is lowered. When reflooded it may not "sponge" back or expand, its elevation remaining the same (excluding future deposition).²² The problem would be compounded by any filling or excavating done after the diking.

The validity of these regulations is the subject of a decision that was handed down 11 May 1978, by the United States Court of Appeals for the Ninth Circuit.²³ In that decision the Court wrote:

We hold that in tidal areas, navigable waters of the United States, as used in the Rivers and Harbors Act, extend to all places covered by the ebb and flow of the tide to the mean high water (MHW) mark in its unobstructed, natural state. Accordingly, we reverse the district court's decision insofar as it found that the Corps's jurisdiction under the Rivers and Harbors Act includes all areas within the former line of MHHW in its unobstructed, natural state. . . .

We therefore hold that the Corps's jurisdiction under the FWPCA extends at least to waters which are no longer subject to tidal inundation because of Leslie's dikes without regard to the location of historic tidal water lines in their unobstructed, natural state. We express no opinion on the outer limits to which the Corps's jurisdiction under the FWPCA might extend. (578 F.2d at 753, 756.)

As with the Corps, two California state agencies charged with regulating coastal development also have their jurisdiction defined by reference to tidal datum planes. The older of the two agencies, the San Francisco Bay Conservation and Development Commission (BCDC), is charged with planning for and regulating development as well as conservation of San Francisco Bay. The commission's jurisdiction includes

(a) San Francisco Bay, being all areas that are subject to tidal action from the south end of the bay to the Golden Gate (Point Bonita-Point Lobos) and to the Sacramento River line (a line between Stake Point and Simmons Point, extended northeasterly to the mouth of Marshall Cut), including all sloughs, and specifically, the marshlands lying between mean high tide and five feet above mean sea level; tidelands (land lying between mean high tide and mean low tide); and submerged lands (land lying below low tide).

(c) Salt ponds consisting of all areas which have been diked off from the bay and have been used during the three years immediately preceding the effective date of the amendment of this section during the 1969 Regular Session of the Legislature for the solar evaporation of bay water in the course of salt production. (Gov. Code section 66610).

The regional and statewide coastal commissions created by passage of Proposition 20 in 1972 were supplanted last year when the legislature passed the California Coastal Act, which created a new statewide California Coastal Commission and six regional commissions. The authority and duties of these bodies are similar to that of BCDC, but their jurisdictions extend to the areas of California's coastline other than San Francisco Bay; BCDC's existence was not altered by passage of the Coastal Act. The jurisdiction of these agencies is the "coastal zone," which is also defined in section 30103 of the Public Resources Code by reference to the MHW line.

²² Deposition of Claire Lopez, Chief Engineer for the Leslie Salt Co. from 1938 to 1964, taken April 23-26, 1973, in *Sierra Club et al. vs. Leslie Salt Co., et al.*, United States District Court for the Northern District of California, No. 72-561, and *State of California vs. County of San Mateo et al.*, San Mateo Superior Court No. 144257, pp. 112, 278-280.

²³ *Leslie Salt Co. vs. Froelike*, 578 F.2d 742 (9th Cir. 1978).

**AN EXAMPLE OF HISTORICAL EVIDENCE:
UPPER NEWPORT BAY, CALIFORNIA**

[illegible]

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comparable to cases within San Francisco Bay. (The reader should bear in mind that the question of the character of the islands was but one aspect of a much larger title dispute, which entailed complicated questions of whether the lands were in fact validly purchased from the State, regardless of their character).

Upper Newport Bay, a tidal estuary, is part of the Newport Canyon. The canyon is the southeastern extremity of a lowland plain which is bounded on the northwest by the San Pedro Hills, thence sweeping inland to the coastal foothills.

The Bay is bounded by uplands, the titles to which were deraigned from rancho grants made by the Mexican government (the Rancho San Joaquin and the Ranchos Santiago de Santa Ana). Upper Newport Bay and the islands lying within it were not included within the patents to the ranchos. During the confirmation proceedings, however, Jose Sepulveda, the ultimate patentee of both ranchos, had claimed the Bay and an island within it. The claim was based in part on testimony of a witness that within the "Bolsa of San Joaquin" was a hummock, a type of island surrounded by marsh, that had been occupied by Sepulveda as a potrero, a place for keeping and raising horses. (Transcript of the proceedings in case No. 406, *Jose Sepulveda, claimant vs. The United States, Defendants* for the place named "San Joaquin" [185 SD p. 8].)

The Ranchos San Joaquin and Santiago de Santa Ana were surveyed for the federal government by Henry Hancock in 1857. The final approved plat of his survey does not show the islands in question, but since they were not included within either of the rancho grants it is not expected that they would have been shown. His field notes, however, include a crude sketch of islands in Upper Newport Bay.

An 1875 U.S. Coast Survey chart entitled "Hydrography of Newport Bay or Santa Ana Lagoon and approaches, scale 1:10,000, 1875," Register No. 1256, shows Upper, Middle and Shellmaker Islands delineated by an "apparent shoreline," an administrative surrogate for the actual mean-high-water line and in the companion topographic map, Register No. 1392, the islands are also delineated by an apparent shoreline and marked with the symbol for swamp.

The islands show on another 1875 map, this one prepared by Los Angeles County Surveyor L. Seebold in connection with an application for Tide Land Location 37. That application concerned lands south of the three islands and characterized the land surveyed as a "piece of swamp and overflowed land." The application states, however, that "... no part of the land sought to be purchased is below low tide ..." which indicates that the land applied for was probably tidelands. But the significant matter is that Upper, Middle and Shellmaker Islands are depicted in a distinctly different manner than the parcel sought to be purchased; an inference is that the islands were of a different character, possibly that they were thought to be swamp and overflowed.

An 1878 map prepared by Assistant Los Angeles County Surveyor Charles T. Healey shows the approximate sites of Middle and Shellmaker Islands as the "tideland locations of C. E. French." Although history has given Healey a reputation for doing his work in the field and not in the office (as was the practice of many of his contemporaries), the map places section lines and corners and many topographical features (including two of the islands, Middle and Shellmaker) approximately 10 chains west of their true position.²⁴ The map shows lots numbered 1 through 9 as French's tideland locations.

The configuration of Healey's Lot 5 resembles Shellmaker Island as it appeared on the later township plat, and Lot 7 generally resembles Middle Island as shown on the township plat. The State Lands Division has in its records an application to purchase these "tideland" lots, and the

²⁴ The most northeasterly island on Healey's map is shown in a much different place than is Upper Island on Finley's township plat, and this difference cannot be explained by Healey's placement of section lines and corners approximately 10 chains west of their true position. This difference (there is only a sliver of overlap) makes it impossible to determine whether these two islands were the same.

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other Lots 1 through 9, under the name Survey Number 12. The application appears to be a copy; the blanks are filled in and signature of C. E. French is in quotation marks. On the cover of this application is the printed phrase "Swamp and Overflowed Lands." Between the words "overflowed" and "lands" a caret adds the words "and tide."

In 1889, Solomon H. Finley completed the Federal township survey of T6S, R10W, San Bernardino Meridian, which showed Upper, Middle and Shellmaker Islands as swamp-and-overflowed lands. There is some indication, however, that Finley surveyed an ordinary-low-water mark instead of the ordinary-high-water mark. This is the conclusion reached by Harris E. Coutchie in a report prepared for the Irvine Company dated August 1971 (*Id.* at p. 7). In addition, Finley may have legitimately believed he was to have surveyed the ordinary-low-water mark. The official government manual for surveyors in effect in 1889 was the General Land Office's 1881 Instructions of the Commissioner of the General Land Office to the Surveyors General of the United States Relative to the Survey of the Public Lands and Private Land Claims. On page 33 of the manual is an erroneous instruction that swamp-and-overflowed lands bordering on navigable lakes and rivers were to be meandered at the ordinary low-water mark.²⁵ Nothing in the manual, however, specifically treats of swamp lands on tidewaters. (See *People vs. Ward Redwood Co.*, 225 Cal. App. 2d 385, 390 [1964].)

Then in 1912, Otto Von Geldern, a renowned coastal engineer, prepared a plat of survey for the U.S. Army Corps of Engineers showing lands of the general shape of Upper, Middle and Shellmaker Islands as swamp. There are contour lines within the swamp, and the map legend states these contours are of a "spring high tide" elevation. If true, this is evidence that portions of the islands were above mean high water in 1912. (No contemporary cartographic manuals of the Corps have been examined.) Conceivably, however, Von Geldern may have actually mapped the mean high tide line.²⁶ If so, this would be the only historic mean-high-tide-line survey of Upper Newport Bay known to us.

Fortunately for the involved parties and any judge who might have had to try to impose order on this chaotic evidence, the dispute was resolved in 1975 in an out-of-court settlement.

TO THE SCIENTIST AND ENGINEER

When the law hears disputes relating to tidal marshes it thus has a vast need for the knowledge of the scientist or engineer on such questions as the natural physical and biological history of marshes, how they respond to man-made changes, and the roles they play in the hydrodynamics and sediment transport in the adjacent water body. The law applicable to a given problem may be intricate, and may change, if subtly, as facts are learned or as studies yield new data. For this reason, to assure that he probes the appropriate questions, the scientist or engineer should demand clear instructions from his client. He should ask for specific formulations of the questions he is to answer and assure himself that he understands them, lest his preparation be misspent in irrelevant or tangential inquiries. He should not tolerate an assignment, for example, simply to locate the "ordinary high water mark" of a parcel of land. He should ask the proper tidal datum to employ, and whether the line is to be located in the present condition, or in some former condition of the

²⁵ This instruction is repeated in the next (1890) edition of the manual. But the 1890 manual added an instruction that lands (not specifying swamp and overflowed lands) bordering on tidelands were to be meandered at the ordinary high-water mark. That the former instruction is erroneous is clear. *Barney vs. Keokuk*, 94 U.S. 325, 338 (1876).

²⁶ See Von Geldern, *The Plane of Ordinary High Tide, etc.*, 29 Pacific Municipalities 243 (June 1915), and the rebuttal of D. E. Hughes, 29 Pacific Municipalities 340, 344 (August 1915).

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land. By the same token he should be tolerant when the law has not caught up with knowledge, when it has not yet developed the sophistication to ask the proper question. Experts and not lawyers taught the Supreme Court the meaning of the tidal datum of MHW, and how that datum might be used to locate the law's—then—ethereal "ordinary high-water-mark." So when the law, as it frequently does, asks the scientist to square a circle, he should assume his duty to educate the law, to enable it to reshape itself and make its provisions congruent with the state of knowledge.

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request is served upon the clerk or secretary of the governing board, the meeting shall be public. Whether the matter is considered at an executive session or at a public meeting, the final action of the governing board of the school district shall be taken at a public meeting and the result of such action shall be a public record of the school district.

CHAPTER 1999

An act to repeal Section 10 of, and to add Section 10 to, the Hunters Point Reclamation District Act (Chapter 1723 of the Statutes of 1955), relating to the Hunters Point Reclamation District.

In effect
September
11, 1957

[Approved by Governor July 8, 1957. Filed with
Secretary of State July 10, 1957.]

The people of the State of California do enact as follows:

SECTION 1. Section 10 of the Hunters Point Reclamation District Act is repealed.

SEC. 2. Section 10 is added to said act, to read:

Sec. 10. When, if, and as any or all of the 200-foot railway right of way and all street areas in the Hunters Point Reclamation District have been reclaimed or filled, the Legislature hereby finds that the trust for navigation and fishery is hereby relieved as to such portion or portions reclaimed or filled.

The State Lands Commission is hereby authorized to grant to this district, to the City and County of San Francisco, or to any person, persons, or corporations, parcels of land, held by the State of California, within the district, upon payment therefor or there being granted to the State of California all right, title and interest of the district, the City and County of San Francisco, or of such person, persons, or corporations in other parcels of land lying and being in the City and County of San Francisco, except that in no event shall any state-owned lands be granted while they are submerged and except that adequate access shall at all times be retained to the then existing waterfront. Such lands to be conveyed to the State shall be of equal or greater value than lands conveyed by the State. The State Lands Commission shall determine the land to be conveyed by, and granted to, the State of California and the value of lands so respectively conveyed by, and granted to, the State of California, which determination shall be final, and, in the event of a deficiency in value of lands conveyed to the State, the State Lands Commission is authorized to accept cash in lieu of land, for the purpose of equalizing values. Any conveyance or exchange of land shall be valued at substantially the appraised market value of said lands as of December 31, 1957.

CHAPTER 2000

Providing for the determination of the boundaries of the tide and submerged lands conveyed to the City of Long Beach, and making an appropriation therefor.

[Approved by Governor July 8, 1957. Filed with
Secretary of State July 10, 1957.]

The people of the State of California do enact:

SECTION 1. The State Lands Commission shall determine the boundaries of the tide and submerged lands conveyed to the City of Long Beach by Chapter 102, Statutes of 1925, and Chapter 102, Statutes of 1925, and Chapter 102, Statutes of 1925. The commission shall survey, map, and determine the boundaries of such lands.

The commission may bring any actions in the superior court to determine such boundaries, and for that purpose may employ counsel.

The commission shall report to the Legislature on or before February 15, 1958, its progress in carrying out this act.

The sum of fifty thousand dollars (\$50,000) is appropriated out of the Investment Fund to the State Lands Commission for the purposes of this act.

CHAPTER 2001

An act to add Chapter 5, commencing with Title 7 of the Government Code, relating to district planning, the financing thereof, the designation of planning areas, the selection of district planning powers and duties thereof.

[Approved by Governor July 8, 1957. Filed with
Secretary of State July 10, 1957.]

The people of the State of California do enact:

SECTION 1. Chapter 5 is added to Title 7 of the Government Code, to read:

CHAPTER 5. DISTRICT PLANNING

Article 1. Declaration of Policy

SECTION 100. In enacting this chapter it is the policy of the Legislature to provide a means for solving problems of development which are not confined to any one city and county planning may be required and the development of the State may proceed more harmoniously.

CHAPTER LXXX.

An Act for the creation of a commission for the promotion of uniformity of legislation in the United States, and to appropriate money for its expenses.

[Approved March 9, 1897.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

Commis-
sioners for
promotion
of uniform
legislation.

SECTION 1. Within thirty days after the passage of this Act the Governor shall appoint three commissioners, who are hereby constituted a board of commissioners by the name and style of "Commissioners for the Promotion of Uniformity of Legislation in the United States." It shall be the duty of said board to examine the subjects of marriage and divorce, insolvency, the form of notarial certificates, descent and distribution of property, acknowledgment of deeds, execution and probate of wills, and other subjects, to ascertain the best means to effect an assimilation and uniformity in the laws of the States, and to represent the State of California in conventions of like commissions to consider and draft uniform laws to be submitted for the approval and adoption of the several States; and to devise and recommend such other course of action as shall best accomplish the purpose of this Act.

Compensa-
tion.

SEC. 2. That said commission shall be allowed, for their traveling and other expenses in effectuating the object of this Act, a sum not exceeding five hundred dollars in the aggregate for any one year.

Appropri-
ation.

SEC. 3. The sum of one thousand dollars is hereby appropriated for the expenses of said commission out of any moneys not otherwise appropriated.

SEC. 4. This Act shall take effect from and after its passage.

CHAPTER LXXXI.

An Act relinquishing to the United States of America the title of this State to certain lands.

[Approved March 9, 1897.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

Relin-
quishing
title to
certain
State lands
to the
United
States.

SECTION 1. All the right and title of the State of California in and to the parcels of land extending from high-water mark out to three hundred yards beyond low-water mark, lying adjacent and contiguous to such lands of the United States in this State as lie upon tidal waters and are held, occupied, or reserved for military purposes or defense, lying adjacent

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presented in Senate and
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the passage of this Act
loners, who are hereby
the name and style of
uniformity of Legisla-
the duty of said board
divorce, insolvency,
and distribution of
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a best means to effect
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conventions of like
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everal States; and to
of action as shall best

be allowed, for their
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and after its passage.

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7.]

resented in Senate and
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the State of California
from high-water mark
ow-water mark, lying
of the United States in
id are held, occupied,
efense, lying adjacent

and contiguous to any island, the title to which is in the United States, or which island is reserved by the United States for any military or naval purposes or for defense, are hereby granted, released, and ceded to the United States of America; the boundaries of each parcel of land hereby granted, released, and ceded to the United States to be a line along high-water mark, a line three hundred yards out beyond low-water mark, and lines at right angles to high-water mark at the points where the boundaries of the adjacent lands of the United States touch high-water mark; provided, that the title to each parcel of land hereby granted, released, and ceded to the United States shall be, and remain in the United States only so long as the United States shall continue to hold and own the adjacent lands now belonging to the United States; and provided further, that this State reserves the right to serve and execute on said lands all civil process, not incompatible with this cession, and such criminal process as may lawfully issue under the authority of this State against any person or persons charged with crimes committed without said lands.

Right to
serve civil
process.

SEC. 2. This Act shall take effect immediately.

CHAPTER LXXXII.

An Act authorizing the Common Council, Board of Trustees, or other governing body of any incorporated city or town other than cities of the first class to refund its indebtedness, to issue bonds therefor, and to provide for the payment of the same.

[Approved March 9, 1897.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. The Common Council, Board of Trustees, or other governing body of any incorporated city or town other than cities of the first class, in this State, having an outstanding indebtedness, evidenced by bonds or warrants thereof, is empowered, by a two-thirds vote of its number, to fund or refund the same and issue bonds of such city or town therefor in sums of not less than one hundred dollars nor more than one thousand dollars each, and having not more than forty years to run, and bearing a rate of interest not exceeding six per cent per annum, payable semi-annually; provided, that no indebtedness shall be refunded at a higher rate of interest than that borne by the original debt. Such bonds shall be of the character known as "serials," not less than one fortieth of the principal being payable each year, together with the interest due on all sums unpaid. Principal and interest on said bonds shall be payable in gold coin or other lawful money of the United States, as may be expressed in said bonds, at the office of the Treasurer of said city or town. Said bonds shall be sold in the manner provided by such City Council or other governing body, to the

Refunding
indebted-
ness of
cities,
other than
of first
class.

Character
of bonds.

Attachment D
Analytical Report

Precision Analytical Laboratory, Inc.

4136 LAKESIDE DRIVE, RICHMOND, CA 94806

PHONE (415) 222-3002

FAX (415) 222-1251

CERTIFICATE OF ANALYSIS

STATE LICENSE NO. 211

Received: 06/07/89

Reported: 06/19/89

Job #: 70875

Attn: George Wilson
Tom Amen
Yosemite & Armstrong
San Francisco, CA.

Lab ID #: 70875-1
Client ID: MW-1 Monitor Well

ANALYSIS:

PCB's as Aroclor 1260 3.7 mg/kg
Halogenated ND<1.0 mg/kg


MDL
0.5
1.0

MDL: Method detection limit; Compound below this level would not be detected.

QA/QC: Spike Recovery for PCB's: 90%

METHODS:

PCB Method EPA 8080
Halogenated by EPA 8010


Jaime Chow
Laboratory Director

Precision Analytical Laboratory, Inc.

4136 LAKESIDE DRIVE, RICHMOND, CA 94806

PHONE (415) 222-3002

FAX (415) 222-1251

CERTIFICATE OF ANALYSIS

STATE LICENSE NO. 211

Received: 06/07/89

Reported: 06/09/89

Job #: 70875

Attn: George Wilson
Tom Amen
Yosemite and Armstrong
San Francisco, CA.

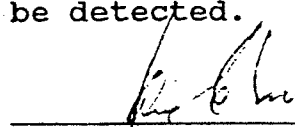
Analysis Method EPA 6010
Prep Method EPA 3050
mg/kg

Lab ID #: 70875-1

Client ID: MW-1 Monitor Well

METAL		MDL	% SPIKE RECOVERY
Tl	ND<2.2	2.2	70
As	ND<2.2	2.2	84
Hg	ND<5.0	5.0	84
Se	ND<5.0	5.0	78
Mo	ND<1.0	1.0	86
Sb	2.0	2.0	80
Zn	14.2	0.15	74
Cd	ND<0.012	0.012	78
Pb	16.9	1.1	80
Co	0.7	0.5	88
Ni	34.9	0.65	82
Cr	6.9	0.15	82
V	42.9	0.1	88
Be	ND<0.025	0.025	86
Cu	12.1	0.1	86
Ag	ND<0.1	0.1	76
Ba	8.2	0.1	92

MDL: Method detection Limit: Compound below this level would not be detected.


Jaime Chow

Laboratory Director

OUTSTANDING QUALITY AND SERVICE
CALIFORNIA STATE CERTIFIED LABORATORY

Attachment E
Health and Ecological Risk

HEALTH AND ECOLOGICAL RISK

This section provides a preliminary assessment of the human health and ecological risk associated with possible exposure to the potentially hazardous substances found in the soil and ground water near the San Francisco Bay Fill Area along Armstrong Avenue and Hayes Street.

Site Contaminants

Chemical analysis of the soil, ground water, and "floating" tar near the Armstrong Avenue and Hayes Street area indicated the presence of potentially toxic substances (borings 7, 8, and 10, Table 1). Soil and ground water concentrations are in mg/kg and mg/l, respectively, essentially equivalent to parts-per-million (ppm mass). The table also shows substances for which no measurements (NM) were obtained as well as measurements for which substances, if present, were less than the method detection limit. The first two pages of Table 1 list organic compounds under broad categories. The third page of Table 1 lists elemental composition under "inorganics" (compound information was not available). Where substances could not be detected (ND), the measurement method detection limit is given in parenthesis. For purposes of a conservative risk assessment, Table 1 lists maximum concentrations only.

Risk To Aquatic Marine Organisms

Estuary (salt marsh) wildlife species consist of vegetation such as Cord grass, Alkali Bullrush, Pickle Weed, Jaumea, Salt Grass, Brass Button, Sea Lavender, Marsh Dodder, and animals such as crab, worms, shrimp, fish, mussels, oyster.

A rigorous quantitative ecological risk assessment is beyond the scope of this preliminary evaluation. Thus, to reduce the complexity of this task, the following conservative assumptions are used . . .

- o Site ground water is directly connected to estuary water.
- o The soil is sandy and porous.
- o No soil absorption occurs.
- o No loss of toxic substances as a result of evaporation and/or chemical-biological transformations.
- o No dilution.
- o Tidal action brings ground water in contact with unsaturated soil above "floating" contaminant.
- o Maximum site concentrations are compared to ambient ocean water quality criteria.

"Indicator" substances have been selected on the basis of their potential toxicity and available information regarding their biological effects on aquatic marine organisms (Table 2). A qualitative risk assessment is derived by comparing the maximum measured concentrations in the site ground water with the ambient ocean water quality criteria for each indicator substance. If the measured concentration is less than the criterion, then it is quite unlikely that any damage to marine organisms will occur as a result of exposure to the "indicator" substance. However, a measured concentration greater than the criterion, allows for the possibility that some adverse effect could occur to some marine species as a result of exposure to the "indicator" substance. But note that owing to the numerous conservative assumptions used in this risk assessment, this latter occurrence (of site concentrations greater than the criterion) does not mean that harmful effects are likely (only possible).

The following is a brief explanation of the data in Table 2. Ambient ocean water quality criteria are derived from the U.S. EPA Integrated Risk Information System (IRIS). Acute (short-term) and chronic (long-term) numerical values are 1-hour and 4-day exposure averages, respectively. These are exposure concentrations for which no observable adverse effects have occurred (NOAEL). Effects on specific species are usually expressed as LC_0^* estimated conservatively as 1/10 of the LC_{50}^{**} value. For the listed organics, these data are from Verschuieren's handbook of environmental information on organic chemicals. (Photosynthesis inhibition is the only effect considered for algae.) Owing to significant differences in their toxicity, chromium(III) and chromium(VI) are listed separately (total chromium concentration in the site ground water is 6.9 mg/l).

As Table 2 suggests, exposure to lead (and to a lesser extent, chromium) may adversely affect some aquatic marine organisms. And although mercury bioaccumulates in fish, there are no known toxic effects. Toxicity to marine organisms from exposure to nickel and zinc is unknown.

Regarding exposure to organic contaminants, it appears that xylene concentrations may just be high enough to possibly affect shrimp and crab larva (the volatility of benzene makes it unlikely that concentrations in estuary water will be high enough to have any significant effects). Some polycyclic aromatic hydrocarbon (PAH) site concentrations of pyrene, fluoranthene, and naphthalene may adversely affect some exposed marine organisms. However, the available data are too limited to be of much use in performing a risk assessment. And although polychlorinated biphenyl (PCB) is known to bioaccumulate in fish, no adverse aquatic toxic effects have been observed.

* LC_0 = Lethal Concentration for which a 96-hour exposure killed no organisms, essentially a NOAEL.

** LC_{50} = Lethal Concentration for which a 96-hour exposure killed 50% of the organisms.

Table 1. Measured maximum concentrations of potentially hazardous substances at the San Francisco Bay Fill Area along Armstrong Avenue and Hayes Street

ORGANICS		
<u>substance</u>	<u>concentration</u>	<u>concentration</u>
	<u>(soil)</u>	<u>(ground water)</u>
	mg/kg	mg/l
MONOCYCLIC AROMATIC HYDROCARBON		
benzene	0.66	0.8
toluene	0.90	0.14
xylene	ND (<0.05)	1.2
ethylbenzene	ND (<0.05)	1.0
POLYCYCLIC AROMATIC HYDROCARBON (PAH)		
naphthalene	ND (<10)	2.7
acenaphthene	NM	ND (<0.005)
acenaphthylene	ND (<10)	0.19
fluorene	ND (<10)	0.38
anthracene	ND (<10)	1.6
phenanthrene	ND (<10)	0.82
fluoranthene	ND (<10)	1.3
pyrene	ND (<10)	1.0
chrysene	ND (<10)	0.36
benz(a)anthracene	NM	0.066
benzo(a)pyrene	NM	ND (<0.01)

Table 1. (continued)

ORGANICS

<u>substance</u>	<u>concentration</u>	<u>concentration</u>
	<u>(soil)</u>	<u>(ground water)</u>
	mg/kg	mg/l
CHLORINATED ORGANICS		
monochlorobenzene	0.15	NM
1,4-dichlorobenzene	0.16	ND (<0.0005)
pentachlorophenol	ND (<10)	ND (<0.0005)
1,1-dichloroethylene (1,1-DCE)	ND (<0.02)	0.2
tetrachloroethylene	0.38	NM
polychlorinated biphenyl (PCB)	ND (<0.1)	3.7
2,3,7,8- tetrachlorodibenzo-p-dioxin (TCDD)	NM	ND (<0.005)
OTHER		
di(2-ethylhexyl) phthalate (DEHP)	NM	0.096
total petroleum hydrocarbon	680	NM

Table 1. (continued)

INORGANICS

<u>"element"</u>	<u>concentration</u>	<u>concentration</u>
	<u>(soil)</u>	<u>(ground water)</u>
	mg/kg	(mg/l)
arsenic	24	ND (<2.2)
antimony	1.4	2.0
beryllium	0.4	ND (<0.025)
barium	NM	8.2
cadmium	12	ND (<0.012)
chromium	50	6.9
copper	440	12.1
mercury	0.039	ND (<5.0)
lead	230	16.9
nickel	140	34.9
silver	0.8	ND (<0.1)
selenium	ND (<0.1)	ND (<5.0)
thallium	0.05	ND (<2.2)
vanadium	NM	42.9
zinc	7,400	14.2
cyanide	4.0	NM

 NM = not measured

ND = not detected

Table 2. Estimate of risk to aquatic estuary/ocean organisms

INORGANICS

<u>"element"</u>	<u>concentration</u> <u>measured</u> (ground water)	<u>ambient ocean</u> <u>water quality</u> <u>criteria</u>	<u>likelihood</u> <u>of possible</u> <u>harm to</u> <u>marine species</u>
	mg/l	mg/l	yes/no
lead	16.9	acute: 0.14 (1 h) chronic: 0.0056 (4 d)	yes yes
chromium(VI)	1.3*	acute: 1.1 (1 h) chronic: 0.05 (4 d)	yes yes
chromium(III)	5.6*	acute: 1.0 (nonsea) chronic: 0.1 (nonsea)	yes yes
mercury	0.039	marine toxicity unknown; bioaccumulation in fish	no
nickel	34.9	marine toxicity unknown	unknown
zinc	7,400	marine toxicity unknown	unknown

*assumption: chromium(III)/chromium(VI) = 6/1

references: 1. Integrated Risk Information System (IRIS)
November 7, 1989

2. Karl Verschueren, "Handbook of Environmental
Data on Organic Chemicals", 2nd edition (1983),
Van Nostrand Reinhold Company Inc., New York, NY

Table 2. (continued)

ORGANICS

<u>substance</u>	<u>concentration</u> <u>measured</u> (ground water)	<u>ambient ocean</u> <u>water quality</u> <u>criteria</u>	<u>likelihood</u> <u>of possible</u> <u>harm to</u> <u>marine species</u>
	mg/l	mg/l	yes/no
benzene	0.8	acute: 5.1 chronic: 0.7 algae: >1,400 crab larva: 11 (LC ₀)** shrimp: 2 (LC ₀)**	no yes no no no
toluene	0.14	crab larva: 3 (LC ₀)** shrimp: 0.4 (LC ₀)** Coho Salmon: 10 (LC ₀)	no no no
xylene	1.2	shrimp: 0.2 (LC ₀)** algae: >5** crab larva: 0.6 (LC ₀)**	yes no yes
ethylbenzene	1.0	algae: >33 Bluegill: >33 (nonsea)	no no

**conservative assumption: $LC_0 = LC_{50}/10$

no effect on photosynthesis = 50% effect/10

Table 2. (continued)

ORGANICS

<u>substance</u>	<u>concentration measured (ground water)</u>	<u>ambient ocean water quality criteria</u>	<u>likelihood of possible harm to marine species</u>
	mg/l	mg/l	yes/no
naphthalene	2.7	algae: >3** Neanthes Arenaceodontata: >0.5	no yes
fluoranthene	1.3	Neanthes Arenaceodontata: >0.5	yes
anthracene	1.6	algae: inhibit photosynthesis? trout: >5 (24 h) oyster: bioaccumulation	no no no
pyrene	1.0	Mosquito Fish: >0.003	yes
chrysene	0.36	Neanthes Arenaceodontata: 3.3**	no
benzo(a)pyrene (BaP)	ND (<0.01)	marine toxicity unknown	unknown
1,1-dichloroethylene (1,1-DCE)	0.2	Menidia Beryllia: 25 (LC ₀)** nonsea fish: 22 (LC ₀)**	no no
polychlorinated biphenyl (PCB)	3.7	fish: toxicity unknown; bioaccumulation	no

**conservative assumption: $LC_0 = LC_{50}/10$

no effect on photosynthesis = 50% effect/10

Risk To Children

Historically, this South San Francisco coastal area has been an industrial/storage region. Therefore, it is a relatively low-population area and few children would be expected to play near the contaminated site. Nevertheless, children playing in the nearby soil is possible and thus, an estimate of health risk is discussed in this section. The following conservative assumptions have been used for purposes of this risk assessment

- o Child has a mass of 10 kg.
- o Child ingests 0.1 g of soil per day over a 70-year lifetime.
- o Maximum site concentrations are compared to No Observable Adverse Effect Level (NOAEL) or Reference Dose (RfD).
- o For indicator substances that could not be detected (ND), it was conservatively assumed that the substance was present in the site soil at a concentration equal to the analytical detection limit.
- o The buried contaminated soil has been brought to the surface catastrophically or by excavation.
- o The surface soil has become contaminated as a result of tidal effects or upward "wicking".
- o Only "human" NOAELs were used for comparisons. Such NOAELs are usually based on animal test data, and typically incorporate conservative safety factors of 1,000.

Although inhalation and skin absorption are possible routes of exposure, they are not likely since the "floating" tarry product is one meter or more beneath the surface and once brought to the surface (e.g., via excavation), the volatile substances would soon be lost to the atmosphere (assessment of chronic effects generally assume a lifetime exposure). Consequently, ingestion will be the only route of exposure considered for assessing the health risk to children.

As for the earlier risk-to-marine-life assessment, "indicator" substances have been selected on the basis of their potential toxicity, available information, and level of concentration at the site in the soil (Table 3). A qualitative risk assessment is derived by comparing the maximum measured concentration in the site soil with the NOAEL or RfD for each indicator substance. For indicator substances that were not analytically detected, it was conservatively assumed that they were present at concentrations equal to their analytical detection limits.

Where possible, in order to minimize the complexity of this assessment, only the toxicological end-points, cancer and birth defects, are considered. A quantitative risk was estimated only for cancer where an oral cancer potency factor (q^*) was known for the indicator substance. The following is an example calculation of the risk of getting cancer as a result of exposure to an indicator substance

Table 3. Estimate of health risk (via ingestion) to child

ORGANICS

<u>substance</u>	<u>concentration</u> <u>measured</u> (soil) mg/kg	<u>exposure</u> (soil eaten) mg/d	<u>NOAEL</u> (RfD) mg/d	<u>cancer</u> <u>potency</u> <u>factor</u> (mg/kg/d) ⁻¹	<u>risk</u>
benzene	0.66	6.6E-5	2.35	2.9E-2	cancer: 1.9E-7 <NOAEL
1,1-DCE	<0.02	2.0E-6	0.0009	6.0E-1	cancer: 1.2E-7 <NOAEL
PAH (BaP)	<10	1.0E-3	0.05	unknown	cancer: unknown <NOAEL
PCB	<0.1	1.0E-5	0.1	7.7E+0	cancer: 7.7E-6 <NOAEL

NOAEL = No Observable Adverse Effect Level

RfD = Reference Dose: an estimate of daily exposure to humans that is likely to result in no significant harmful effects during a lifetime

references: 1. "Toxicological Profiles for PCB, 1,1-dichloroethylene, benzene, and benzo(a)pyrene", U.S. EPA draft document prepared for the Agency for Toxic Substances and Disease Registry (ATSDR)

2. IRIS (November, 1989)

Table 3. (continued)

INORGANICS

<u>"element"</u>	<u>concentration</u> <u>measured</u> (soil) mg/kg	<u>exposure</u> (soil eaten) mg/d	<u>NOAEL</u> (RfD) mg/d	<u>cancer</u> <u>potency</u> <u>factor</u> (mg/kg/d) ⁻¹	<u>risk</u>
lead	230	2.3E-2	1.0E-4	unknown	cancer: slight >NOAEL
zinc	7,400	7.4E-1	11E+0	unkown	<NOAEL
chromium(VI)	8.3*	8.3E-4	5.0E-2	4.1E+1	cancer: 3.4E-3 <NOAEL
chromium(III)	41.7*	4.2E-3	15E+0	unknown	<NOAEL
mercury	0.039	3.9E-6	3.0E-3	unknown	<NOAEL
nickel	140	1.4E-2	2.0E-2	unknown	<NOAEL

*assumption: chromium(III)/chromium(VI) = 6/1

references: 1. IRIS (November 1989)

2. "Toxicological Profiles for lead, zinc, chromium, mercury, and nickel", U.S. EPA draft document prepared for the Agency for Toxic Substances and Disease Registry (ATSDR)

$$\text{Lifetime Cancer Risk} = (q^*)(\text{exposure}) \dots\dots\dots(1)$$

Since q^* is in units of $(\text{mg}/[\text{kg body mass}]/\text{d})^{-1}$, exposure must be in units of $(\text{mg}/[\text{kg body mass}]/\text{d})$, for lifetime risk to be unitless. Assuming that the exposure is to a 10-kg child, the listed values of exposure in mg/d (Table 3) can be converted to $\text{mg}/\text{kg}/\text{d}$ as follows:

$$\text{mg}/\text{kg}/\text{d} = (\text{mg}/\text{d})/(10 \text{ kg}) \dots\dots\dots(2)$$

The following is an example calculation of the incremental risk of a child ingesting benzene from the site contaminated soil.

$$\begin{aligned} \text{Benzene Ingested} &= (\text{concentration in soil})(\text{soil mass ingested}) \\ &= (\text{mg}/\text{kg})(\text{kg}/\text{d}) \dots\dots\dots(3) \\ &= (0.66 \text{ mg}/\text{kg})(0.1 \times 10^{-3} \text{ kg}/\text{d}) \\ &= 6.6 \times 10^{-5} \text{ mg}/\text{d} \\ &= 6.6\text{E-}5 \text{ mg}/\text{d} \text{ in engineering exponent notation} \end{aligned}$$

And using equation 2, the exposure for a 10-kg child in terms of $\text{mg}/\text{kg}/\text{d}$ is:

$$\begin{aligned} &= (6.6 \times 10^{-5} \text{ mg}/\text{d})/(10 \text{ kg}) \\ &= 6.6 \times 10^{-6} \text{ mg}/\text{kg}/\text{d} \end{aligned}$$

And substituting into equation 1:

$$\begin{aligned} \text{Lifetime Cancer Risk} &= (2.9 \times 10^{-2})(6.6 \times 10^{-6}) \\ &= 1.9 \times 10^{-7} \\ &= 1.9\text{E-}7 \text{ in engineering exponent notation} \end{aligned}$$

This means that the estimated chance of getting incremental cancer during the child's lifetime from daily ingestion of the benzene-contaminated soil is about 2 in 10 million. Or in an exposed population of 10 million children, 2 children will get cancer as result of this type of exposure.

Regarding reproductive effects, only lead showed $>\text{NOAEL}$. The other indicator substances all resulted in $<\text{NOAEL}$. And only exposures to chromium(VI) had potentially significant ($<1:100,000$) risk of getting cancer. Zinc and chromium(III) are essential trace elements for human health.

Health Risk To General Populace

Because this South San Francisco coastal area has never been and probably will never be used as a source of drinking water, contamination of the ground water is unlikely to be a significant hazard to adult humans near the contaminated site. The only possible route of exposure for people occupying new buildings near the contaminated site is inhalation. As a result of excavation or a catastrophic event (e.g., earthquake), volatile components of the tarry "floating" product may be released, finding their way into a building through air intakes, open windows, or foundation cracks. Such exposures would be essentially to the volatile organics and not to the involatile inorganics (elements or metals). Of possible greater concern, is the potential exposure to excavation workers. During operations, they might inadvertently expose themselves to hazardous components of the tarry "floating" product or to contaminated soil. Here, besides inhalation, is the possibility of dermal exposure.

The volatile, potentially hazardous substances found at the site are benzene, toluene, xylene, ethylbenzene, 1,1-dichloroethylene, tetrachloroethylene, and naphthalene. Of these, only benzene and 1,1-dichloroethylene pose any significant threat of cancer. Short-term exposure to these two toxic substances are unlikely to be harmful. A quantitative health risk would use inhalation cancer potency factors (q^*) along with estimated exposures (mass and duration). This is currently not within the scope of this effort. Inhalation exposure to nonvolatile toxic inorganics may occur from dust generated during excavation operations.

Summary Of Health-Ecological Risk And Recommendations

This preliminary risk assessment suggests that there may be some adverse effects to marine and human life as a result of exposure to some toxic substances from the Armstrong/Hayes area. The contaminants of greatest concern appear to be lead and chromium. However, the available data are much too sparse to provide a true quantitative risk assessment. Recommendations are as follows:

- o More sampling and chemical analyses to provide statistically defensible information.
- o Increase the sensitivity of the chemical analytical method for PAH in soil.
- o Determine the compound form (at least the valence state) for the most toxic "elements".
- o Remediation will be guided by an accurate risk assessment.

SOURCES OF CONTAMINANTS

This section delineates possible sources of the contaminants found at the Armstrong/Hayes South San Francisco Bay fill area. Because of the proximity of a lumber yard, additional detail is provided regarding the possibility of contaminants from past wood operations.

Lead

- o Mining operations
- o Storage batteries
- o Ammunition
- o Solder
- o Pipes (old)
- o Gasoline additive

Zinc

- o Smelting operations
- o Foundries (brass alloying)
- o Metal plating
- o Welding operations
- o Galvanized metal containers

Mercury

- o Thermometers
- o Barometers
- o Medical/Dental operations
- o Industry
- o Bioaccumulated in fish
- o Naturally occurring

Nickel

- o Mining operations
- o Steel manufacturing
- o Electroplating
- o Nickel-Cadmium batteries
- o Permanent magnets
- o Fuel oil (diesel)
- o Medical-Dental operations
- o Consumer products

Chromium

- o Mining operations
- o Steel manufacturing
- o Pigments
- o Leather tanning
- o Wood treatment
- o Water treatment (e.g., cooling towers)
- o Plating operations
- o Metal/Glass cleaning

Benzene

- o Gasoline
- o Solvent (e.g., paint stripper)
- o Chemical industry
- o Manufactured-gas waste sites

1,1-Dichloroethylene

- o Plastics (e.g., Saran wrap)
- o Flame retardant fabrics
- o Solvent
- o Adhesives

PCB

- o Transformers
- o Capacitors
- o Fluorescent light ballasts

PAH

- o Fossil fuel combustion product
- o Coal tar
- o Wood treatment (creosote)
- o Asphalt
- o Manufactured-Gas waste sites

Wood Treatment Operations

What evidence is there to suggest that the nearby lumber yard has contributed some of the contaminants on the Armstrong/Hayes site? The following briefly discusses the chemicals that are used in typical wood treatment operations. These are compared to the contaminants found at the Armstrong/Hayes site.

While wood treatment operations are quite diverse, there are three major chemicals that are most successfully used to preserve wood. These are:

- o Pentachlorophenol
- o Creosote
- o Copper/Chromium/Arsenic salts

Copper, chromium, and arsenic are indeed found at the contaminated site. And some components of creosote (the PAH) are also present at the site. But creosote is basically a mixture of phenols, with only minor amounts of PAH. Phenols (including pentachlorophenol) were not found at the site. This, reduces the likelihood that the nearby lumber yard is significant contributor of contamination to the Armstrong/Hayes site.

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